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THE LAKE ELLESMERE SUBMERGED LANDS.

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LAKE Ellesmere is a large shallow lagoon in Canterbury, lying immediately to the west of Banks Peninsula and between the townships Little River and Southbridge, and is only separated from the Pacific Ocean on its southern boundary by a gravel bank through which the lake occasionally breaks, later letting in the sea-water which alters the salinity of the lake waters from time to time. The area covered by water is roughly about 100 square miles, and the depth of the water is never more than 8 ft. Such a large expanse of water would naturally be the resort of all kinds of water birds, and Ellesmere at present is therefore chiefly known as a sportsman's hunting-ground.

Such farms as occur on the borders of the lake are unusually fertile, and land reclaimed has also given excellent results. It is therefore not to be wondered at that engineers have turned their attention to the possibility of reclaiming the whole of this immense unoccupied area by appropriate measures and erecting suitable works to prevent subsequent flooding either from sea or from inland waters.

Dr. P. Marshall, Consulting Geologist to the Public Works Department and Highways Board, has gone over the site of the proposed reclamation very carefully and drawn samples at all depths from the lake bottom, over eighty samples being collected. These were all examined at first for their mechanical composition, which then enabled the material to be grouped in series according to the texture. Composite samples were then made and these were fully analysed. Results show that there is no sample finer than a silt loam, and hence no great difficulty would be experienced in cultivating the soils resulting from drainage.

The chemical analyses here tabulated show that the samples are abnormally rich in available phosphates, potash, magnesia, and lime, while the total plant-food is also very high compared with that of average New Zealand farm soils in all mineral fertilizer constituents except total phosphoric acid, and this is present in amounts which

would be considered normal. The amount of nitrogen is, however, low, but this may be expected to increase rapidly on working the soils. If this weak spot in the composition is remedied Ellesmere soils should prove highly productive in yielding market-garden and other crops of great advantage to dairy-farmers and nearby residents of Christchurch City.

These samples bear out the results obtained from similar positions elsewhere, and indicate that sea littoral situations which are at times dominated by salt water, whether from spray or actual submergence, are always high in available mineral plant-food. In this case the available phosphoric acid is from four to six times that found on normal soils, while the total amount is normal.

It may be considered, therefore, that the reclamation of this large area of flat land of good texture and excellent chemical composition, with easy access by good roads to a large city, will supply intending settlers with excellent land for selection.

The water in the lake is said to contain usually one-fifth of the salt contained in sea water, but no samples were submitted for analysis. In addition to the land actually reclaimed from the lake bottom, it is thought that on account of the lowering of the water-table 100,000 acres of farming land in the vicinity would be improved.

Appended is the illuminating report of Dr. Marshall on the physical results of his survey. Other aspects of the subject will be dealt with in a later article.

ANALYSES OF SAMPLES TAKEN FROM LAKE ELLESMERE BOTTOM.

Results, except *, are percentages on soil dried at 100° C.

Laboratory No.	Mechanical Texture.	Volatile Matter.		Total Nitrogen.	1-per-cent. Citric-acid Extract, Dyer's Method, Hall's Modification. ("Available Plant-food.")				Hydrochloric-acid Extract. ("Total Plant-food.")			
		*At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.
B/1686	Composite silt loam	1·24	3·12	0·057	0·276	0·115	0·043	0·065	1·58	1·70	1·18	0·10
B/1687	Composite loam	1·20	3·48	0·060	0·262	0·112	0·043	0·051	1·61	1·71	1·12	0·08
B/1688	Composite loamy silt	0·84	2·74	0·040	0·346	0·096	0·038	0·044	1·56	1·58	1·11	0·11
B/1689	Composite fine sandy loam	0·40	2·57	0·033	0·338	0·075	0·031	0·038	1·75	1·52	1·10	0·08
B/1690	Composite fine sand plus coarse sand	0·46	1·67	0·023	0·140	0·069	0·026	0·046	0·86	0·89	0·72	0·07

REPORT ON THE BASIN OF LAKE ELLESMERE, WITH SPECIAL REFERENCE TO SOURCE OF THE WATER AND BOTTOM DEPOSITS.

THE shape of Lake Ellesmere is almost that of an equilateral triangle, with a base of fourteen miles long extending north 80° east. The altitude of the triangle is eight miles. The other sides are approximately ten miles long and face east-south-east and south-west respectively.

The Selwyn and No. 2 Rivers enter the lake at its northern angle, the apex of the triangle. The Halswell and Kaituna enter it near its eastern angle. The Irwell and Hart's Creek enter it on the side facing east-south-east.

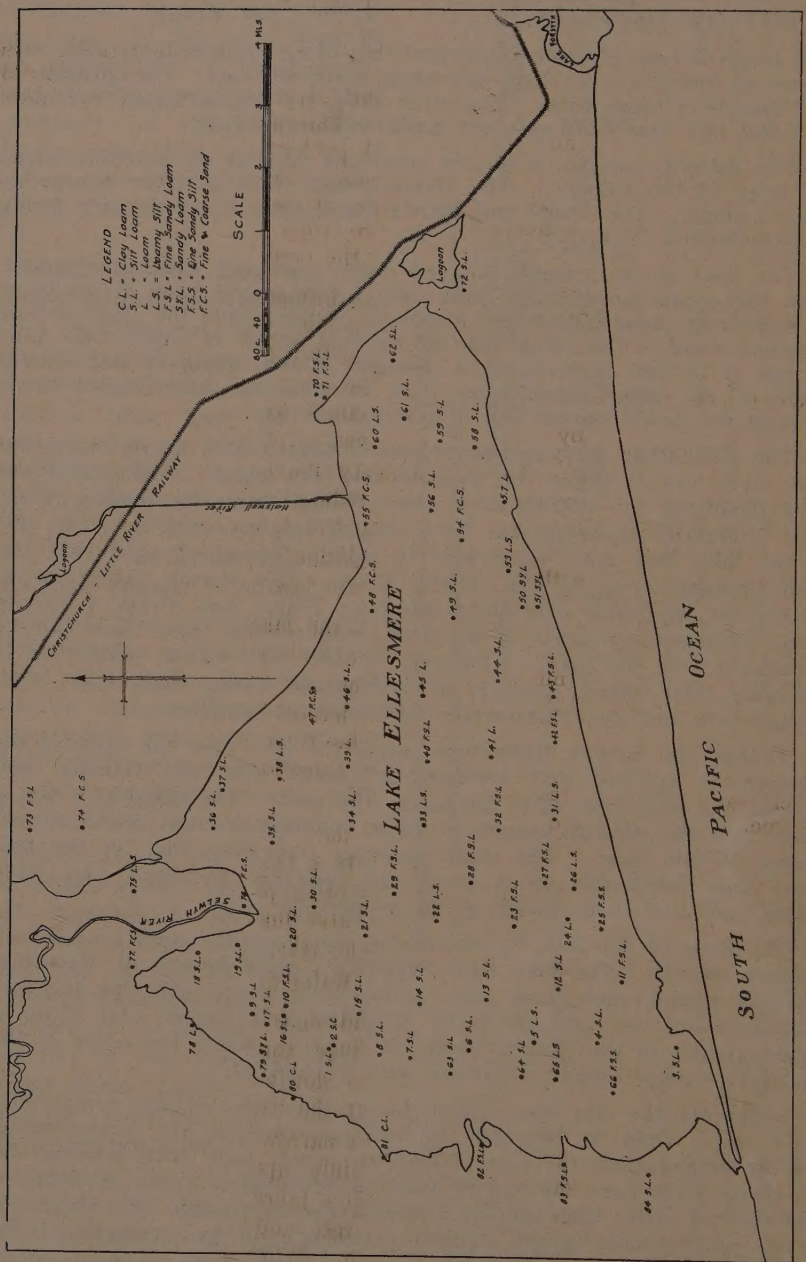
The base of the triangle, aligned nearly east and west, is separated from the ocean by a gravel bank only. This gravel bank is composed of wave-worn shingle, and its component pebbles have the characteristic flattened form. The bank has an average width of about one mile, though it is very narrow for a distance of two miles at the western point of the lake, where from time to time the lake waters break through the gravel barrier and flow into the ocean.

The shore that faces east-south-east is formed of a gravel bank that rises 10 ft. – 15 ft. above the level of the lake water. This gravel has been deposited by distributaries which flowed from the Rakaia River. Near Taumutu its fringe has been shaped by wave action. The side of the lake that faces south-west is mainly formed of sand that has been brought down by the Selwyn River. This stream carries gravel throughout its course over the Canterbury Plains, but within a mile of Lake Ellesmere its grade is so much reduced that sand only can be transported to the lake. This side of the lake facing south-west is low-lying and much subject to inundation during high lake level, though here and there the surface rises into low sand-dunes.

Though the Selwyn River now enters the lake near the apex of the triangle, it appears that formerly it united with the Halswell and entered the lake four miles farther to the east. The lagoons of No. 2 River and the Ahuriri Lagoon probably indicate portions of the former course of this river. The sand that the river deposited on the lake shore was distributed in a south-east direction by wind and wave action, and now even reaches as far as Kaituna.

The floor of the lake is remarkably flat, and the water is nowhere as deep as 8 ft. The lake shore supports a thick growth of vegetation of reeds, rushes, rank grass, and various other plants, and this normally extends about one mile from the low-water line, though this width is rather greater in the eastern corner of the lake, where the whole of the relatively narrow tongue is covered with water-weed.

Ordinarily the lake has no outlet, and since the streams bring down more water than is removed by soakage through the gravel-bank, and by evaporation, the lake waters rise slowly until with artificial aid the water flows over the narrow bank at the western point of the lake. The rush of water then quickly erodes a narrow passage, and thereafter for a period whose length depends mainly upon the strength of the ocean swell regular tidal inflow and outflow takes place. The prevailing ocean swell always acts from the south-west, and washes gravel, brought down by the Rakaia, along the beach. When the waves are high



MAP OF LAKE ELLESMERE, SHOWING LOCATIONS OF SAMPLES TAKEN AND ANALYSED.

enough the movement of gravel along the beach is so great that the outlet is blocked. The inflow of salt water ceases until once again the lake rises high enough to break across the gravel barrier.

The salinity of the lake therefore varies considerably from time to time, but is always relatively low, for the tidal range is only 6 ft. The amount of salt water in the lake is often augmented by sea-water washing over the gravel bank at its western end. No true salt-water mollusca were found in the lake. The plants that grow on the flats laid bare by the lake water when the level falls are varied, and indicate a small amount of salinity at all times.

In the district round Lake Ellesmere artesian wells are general. These are in use from Kaituna at the east point to Taumuterau on the west, and one is actually within a quarter of a mile of the ocean shore. Natural artesian springs abound at Lincoln, where, however, they issue for the most part at the bottom of a small dip 15 ft. below the general ground surface. The question at once arose as to the possible occurrence of artesian springs on the bed of Lake Ellesmere. Locally such springs are spoken of at Taumutu, mouth of Hart's Creek, Marshall's Road, mouth of Selwyn, and a gravel spit near the lake-entrance close to Kaikanahi.

These places were visited in November, 1931, and in all cases it was found that the flow of water from the springs was so small as to be negligible. Water had then been flowing from the outlet of the lake for three weeks and the level was low. The springs were also shallow; the greatest depth found was 17 ft. in a spring on the side of the lake facing east, near Taumutu, a quarter of a mile north from the end of Taiaroa's trees. The outflow of this, which was far the most active of all the springs seen, was $4\frac{1}{2}$ cubic feet per *minute*. In all cases these springs have wide orifices, though these are sometimes partly covered by plant growth which will barely support a man's weight.

The small depth and trifling outflow showed at once that none of these springs issued from an artesian source or stratum. The larger springs were often about 3 ft. below high lake level, and decreased in number and size as the low lake level was approached. Some of the orifices, in particular that near Kaikanahi, are crateriform, a shape which suggests that at times water issues from them in considerable volume.

The situation, arrangement, and small outflow of these springs suggest that they are orifices through which water that has saturated the surrounding strata after heavy rainfall at high lake level escapes when the lake level falls. As this fall of level is rapid, the unwatering of the surrounding porous rocks which are generally sealed along the lake margin will give rise temporarily to a considerable outflow of water at these points, which, however, will decrease rapidly in amount.

No artesian spring nearer to the lake than Lincoln was definitely seen, though it is possible that there are some in the bed of No. 2 River or in the Halswell. If so, the water merely augments the outflow of these streams.

No evidence could be found of the existence of any artesian springs on the floor of the lake. Such springs would probably form small craters from the fine sand and other sediment which covers the floor of the lake. Since the maximum depth of the lake is 7 ft. below sea-level, it is probable that the waves developed by strong winds would break on the ring-shaped mounds if present. Nothing of this sort was seen, and local boatmen had no knowledge of anything of this nature.

The lake water is normally discoloured by the suspension of fine sediment. Artesian water is particularly clear. In periods of calm, when no wavelets disturb the water, patches of clear water would surely mark the situation of artesian springs if any existed. Whilst the samples were being taken in November, 1931, there were several still nights and mornings, and on occasions there was no wind throughout the day. No instance was seen of any change in the colour of water due to a smaller amount of suspended sediment.

Except near the outlet and close to the shore facing south-west the floor of the lake is covered with exceedingly fine sediment, certainly several feet in thickness. This will tend to act as a seal, preventing the outflow of water from subjacent porous beds.

These considerations and observations taken together almost amount to a proof that no artesian springs issue on the floor of Lake Ellesmere.

Distribution of Deposits on the Floor of the Lake.—A series of samples was obtained by forcing an iron pipe fitted with a piston into the material of the floor of the lake. Sixty-six samples were taken systematically from the lake floor. Other samples, taken from the shore close to the lake, raised the total to eighty-four. A mechanical analysis of each of the samples has been made by the Department of Agriculture. The results show that almost throughout the lake floor is covered by a deposit which contains from 20 to 55 per cent. of silt, with 5 to 35 per cent. of clay.

Fine sand and coarse sand are found near the mouth of the Selwyn, and generally on or near the shore that faces south-west. This material has been brought down by the Selwyn, mainly at a time when its mouth lay farther east than now. Sandy loam and fine sandy loam cover a wide area of the lake floor extending outward with a rounded outline four miles northward from the shingle-bank shore and five miles along it. The sand content of this material is due to the suspending and transporting power of the south-west wind, which in time of storm blows fine sand from the bare seashore near the oulet of the lake. Farther east there is less bare beach material—the gravel spit becomes rather higher and wider, and is covered with vegetation which interrupts the transport of the sand.

The rest of the floor of the lake is nearly all covered with silt loam, or in places with material graded as loam or as loamy silt. The fine constituent of all these has been brought down by various streams, and owing to the minute size of the grains it was distributed widely by water circulation before it was deposited.

—*P. Marshall.*

Chapman's Seedling Strawberry.—Mr. J. O. Anderson, Orchard Instructor, Motueka, sends the following note: "A seedling strawberry, first grown by Mr. R. Chapman, Umukuri, four years ago, is now being extensively planted in the Motueka district. The plant is a very strong upright grower, and a heavy cropper of very fine round-shaped berries, which have this season commanded a high price on the Wellington market. A strong feature of the plant is its resistance to disease. This season leaf-spot, mildew, and root trouble has done considerable damage, some areas being rendered practically useless, principally those of the Ettersburg strain. Chapman's Seedling has so far resisted disease, and where grown the plants are a picture of health. The plants in the original plot, which is now four years old, are still strong and vigorous, and free from disease."

SWINE FEVER.

SOME CURRENT INFORMATION FOR FARMERS.*

W. C. BARRY, M.R.C.V.S., District Superintendent, Live-stock Division, Wellington.

AN outbreak of swine fever having been recently confirmed by the Department of Agriculture to exist on several pig-farms in the neighbourhood of Wellington, pig-breeders and farmers generally will be interested in some information pertaining to the disease, and more particularly regarding its existence in New Zealand.

This disease of pigs was recorded as having been prevalent on the Continent of Europe over a century ago. From Europe it spread to America in the year 1833. The exact date at which the disease appeared in Great Britain and the place of origin are not known, but available evidence points to the disease being introduced from the Continent prior to the year 1858. From that period onwards the disease received considerable attention from English, American, and Continental veterinary authorities. The name "swine fever" was first given to the disease in 1880 by the late Sir George Brown, a prominent British veterinarian of that period, who prepared a parliamentary report on the subject in 1886, in which he described the symptoms and *post-mortem* lesions. In 1893 the Board of Agriculture in England, and the Veterinary Department of Ireland, took over control of the disease, and those authorities are still engaged in an endeavour to banish it from the British Isles.

GEOGRAPHICAL DISTRIBUTION AND ECONOMIC IMPORTANCE.

Swine fever is a very widely spread, if not universally distributed, disease. It is certainly the most widespread of epizootic swine diseases, and causes enormous loss in all European countries, America, and Great Britain.

In America the disease receives the designation of "hog cholera," and it is always referred to by that name in the United States. Confusion sometimes occurs through this different nomenclature, and it is important to remember that hog cholera, as it is spoken of in America, is the same disease as that called swine fever in British countries. The first identified outbreak of swine fever in the United States occurred in Ohio in 1833, and its spread from this centre to the other States was remarkable. From the original centre it has spread widely, and now prevails more or less continuously in every State of the Union, as well as in the surrounding countries, including the island possessions of the United States.

The losses caused by the disease in the United States have been enormous, as shown by the following figures: In the year 1873 it caused losses amounting to 20,000,000 dollars; in 1882, 13,000,000; in 1884 and 1885, 25,000,000 and 30,000,000 dollars respectively;

* Lecturette broadcast from Radio Station 2YA, Wellington, 23rd May, 1933.

while in 1888 the loss was estimated to have affected 45,000,000 pigs of a value of 200,000,000 dollars. In 1914 the losses were estimated at 100,000,000 dollars. The eradication procedure undertaken by the Bureau of Animal Industry in the United States resulted in reducing the losses of pigs from swine fever in that country from 11·8 per cent. in 1914 to 4·14 per cent. in 1919, the number of pigs increasing during the same period by 4,000,000. Nevertheless, in 1918, of the total number of 75,000,000 pigs, 2,815,900 became victims of the disease. The control of swine fever has been conducted by the Bureau of Animal Industry since 1914 according to a definite plan and with great persistence. The Bureau maintains veterinary inspectors in the various States for the purpose of supervising the sanitary condition of the pigs as well as for the direction and control of the eradication measures.

The disease was introduced into Denmark in 1887, and spread into Sweden the same year. In France swine fever is widely spread, all parts of the country being infected with the disease. In 1908 from thirteen to twenty districts were said to have been involved in a severe outbreak. In Germany the disease is also widespread, and in 1911 the losses were recorded as involving 63,000 pigs. Austria and Hungary were invaded in 1895. The disease is also known in Central and South Africa.

In Great Britain and Ireland swine fever is a continuous menace to the pig-breeding industry. For a time the disease diminished in Great Britain as a result of the measures of eradication which were inaugurated in 1893. In 1894 5,862 outbreaks were confirmed, whereas in 1905 only 817 occurred. However, in 1906 the disease again extended, and in 1911 2,466 outbreaks occurred. The report issued by the Ministry of Agriculture in England for 1931 gives the number of outbreaks during that year as 2,026.

Australia has had periodic outbreaks of swine fever during the past thirty-five years. Victoria appears to have been the chief centre of occurrence. A series of very severe outbreaks occurred, however, in New South Wales during 1927 and 1928. The origin of this outbreak was traced to a consignment of pigs from Victoria. About the same time South Australia and Tasmania reported swine fever, also following the introduction of Victorian pigs. The centre of infection in Victoria is understood to have been Melbourne. Victoria had for some years previously been reported free from swine fever. The inference is very strong that the Victorian outbreak had its origin in garbage from overseas ships.

In the 1927–28 outbreak in New South Wales, which occurred in the County of Cumberland, in which Sydney is situated, ninety-nine outbreaks occurred, and the number of pigs destroyed as diseased or in contact was 13,418. This outbreak lasted two years, extensions and recrudescences occurring over that period. Every outbreak not directly associated with the original Victorian infection was among garbage-fed pigs. Garbage feeding does not produce swine fever, provided the garbage is free from infection, but it is a rapid method of disseminating the disease once infected pork or bacon goes on to the market.

The history of swine fever in New Zealand is unique in that this country had been free from the disease for a very long period of years. The first official recognition of swine fever in New Zealand occurred in 1895, when Dr. J. Gilruth, then Chief Veterinarian, confirmed the existence of the disease at Dannevirke. During the same year an outbreak was confirmed at Stirling, Otago. In both instances slaughter of the entire herd of pigs was carried out, and it was hoped that the disease had been exterminated. However, in 1898 a serious outbreak occurred at Mataura, Southland, investigations in this instance being carried out by Dr. C. J. Reakes, the present Director-General of Agriculture. From 1898 until 1902 various outbreaks occurred, the locations being in the Southland, Taranaki, Auckland, and Wellington Districts. Since 1902 New Zealand has been free from swine fever, a period of freedom not paralleled by any other pig-rearing country.

Having discussed at some length details referring to the world-wide distribution of swine fever and the enormous economic loss it is capable of producing, we shall now consider some salient features of the disease itself.

Cause of the Disease.

Swine fever is a highly contagious disease caused by a virus, and is entirely peculiar to the pig. Not only is it never seen in any other animal naturally, but all attempts to transmit it experimentally have failed. Man is not affected, and there is no danger even if pork infected with the disease is consumed.

The virus which causes swine fever cannot be seen by the highest powers of the microscope, and for this reason it is termed "ultra-microscopic." It is so minute that it will pass through the pores of the finest bacteriological filter. Up to the year 1904 it was generally accepted that the cause of swine fever was a small bacillus or germ which was invariably found in certain of the lesions, and this germ was then termed the "swine fever bacillus." In 1904, however, some veterinary investigators in America showed the disease to be really due to a filterable virus, and this view is now universally accepted, the so-called "swine fever bacillus" being believed to be a secondary factor.

The length of time during which the virus or poison retains its virulency has an important bearing in the spread and control of the disease. As in other diseases of a similar type of causation, the virulence of the virus varies in different outbreaks. Speaking generally, however, it is considered that the infection on infected premises does not persist for a great length of time. This is, however, influenced by the season of the year, as in cold temperatures it lives much longer. One American authority states that it can survive a single winter.

Some interesting experiments regarding the viability of the virus were recently conducted at the Laboratory of the Ministry of Agriculture in England. The experiments were designed to show the viability of the virus in the bone marrow, muscle, and skin of cured carcasses of pigs killed in the early stage of the disease and before the appearance of symptoms. Briefly, the results went to

show that the virus survived seventy-three days in the bone marrow of salted and chilled carcasses, and for thirty-seven days in the bone marrow and muscle of smoked carcasses. The practical importance of this is enormous, as it goes to show that spread of the disease can be maintained through feeding back to pigs scraps of bacon or pork from carcasses of pigs killed when infected but not yet showing any symptoms, such scraps being contained in garbage.

Manner of Spread.

The blood of pigs suffering from swine fever contains a large amount of infective agent, and as the blood flows through all the organs and tissues these also contain it. All the discharges contain the virus to a greater or less extent, and discharges from the intestines are particularly dangerous. Healthy pigs are readily infected by swallowing infected material, also by association with diseased animals and from infected premises, litter, &c. Infected material can be carried on the boots or clothes of attendants or others to neighbouring places. Birds or dogs can convey infection on their feet from place to place. As explained previously, garbage containing scraps of pork or bacon from infected pigs can become a fruitful source of dissemination. All garbage should be thoroughly boiled before being fed to pigs.

Symptoms of the Disease.

In every contagious disease there is an interval between the time of infection and the appearance of the symptoms of the disease; this is called the incubation period. The period of incubation in swine fever is about three to ten days. Some animals may not show outward symptoms until about ten days after infection.

The symptoms vary according as the disease shows itself in the acute, subacute, or chronic form. An outbreak may be ushered in with cases of an acute type, killing off the most susceptible animals, followed by the subacute and chronic forms. On the other hand, an outbreak may begin and end with acute cases: it seems to depend on the virulence of the virus. Young pigs are more severely and rapidly attacked than older pigs.

In acute cases the animals refuse food, shiver, and may lie in a corner of the sty. There is frequently a catarrhal discharge from the eyes, the eyelids being glued together. The temperature is high, running up to 106° or 108° F. Diarrhœa may be present. Discoloration of the ears, abdomen, and thighs may or may not appear. There is great prostration, and the pigs gradually become comatose and die after an illness of from two to four days.

In subacute cases the more typical clinical symptoms are seen. Only a proportion of the herd is ill at any time and the period of illness is much longer than in the acute type. A rise of temperature from 103° to 107° F. is the first symptom observed; this is quickly followed by prostration, shivering, and loss of appetite. When the lungs are affected hurried breathing and cough will be present. The pigs gradually weaken, and when made to move they

stagger about in a drunken fashion, the hindquarters swaying from side to side, indicating loss of muscular power. Thirst is frequently noticed.

In the chronic form the symptoms are not so well marked. The pigs have a hard, stunted, unthrifty look, and the skin is of a pale ashy colour. Chronic cases have been met with where extensive ulceration of the bowel was revealed on *post-mortem*, although the animals showed very few symptoms during life. A considerable number of pigs affected with the chronic form may live for thirty days or longer.

The average death-rate in swine fever is very high. It may even amount to 100 per cent. of the pigs on the premises.

Pig-owners should suspect swine fever under the following circumstances :—

(1) When a number of pigs are dying.

(2) When a number of pigs are sick or unthrifty.

(3) When periodic deaths are occurring, even if the remaining pigs appear healthy.

(4) When large numbers of suckling or newly weaned pigs are dying, even if the older animals appear to be healthy.

The fact that no new pigs have been brought on to the premises for some months does not justify the owner in thinking that mortality is not due to swine fever.

Post-mortem Appearances.

The *post-mortem* symptoms are more the concern of the veterinarian, but as a matter of interest may be briefly referred to. The carcass of a pig dead from swine fever may show red to purple patches on the skin of the ears, abdomen, and thighs. On opening the carcass the intestines may show numerous small red blood-spots (hæmorrhages). These spots are not peculiar to the very acute forms, but may also be seen in the more chronic cases.

On opening the stomach a deposit is found in the form of a yellowish membrane on the inner lining. This deposit, known as a diphtheritic lesion, is a common *post-mortem* finding in the present (Johnsonville) outbreak. The inner lining of the bowel is very congested, and ulceration is frequent here. Ulcers are found in the large bowel about the junction of the end of the small bowel and the blind gut known as the cæcum. But it must be remembered that it does not follow that the disease is not swine fever because typical ulceration is not found. Congestion of the mucous membrane or lining of the bowel should always be looked upon with suspicion, particularly if it is combined with inflammatory symptoms in the lungs. The heart often shows the blood-spots before referred to.

Testing for the Disease.

For confirming the existence of swine fever a small quantity of blood from a suspected pig is injected into a healthy pig. If the case is one of swine fever, the injected pig will develop the disease in the course of four to nine days. This blood transmission test has been carried out at the Veterinary Laboratory, Wallaceville, in all outbreaks during the present epidemic in Wellington.

The Wellington Outbreak.

In connection with the present outbreak, the existence of swine fever was definitely confirmed by the Department of Agriculture to exist on two pig-farms in the Johnsonville locality on 12th May. Since that date further cases have been discovered on seven other premises, the latest being at Lower Hutt. All affected and in-contact pigs have been slaughtered, involving the destruction of 1,607 pigs. A quarantine area including the Makara and Hutt Counties has been gazetted, and drastic restrictions on movement of pigs enforced. An exhaustive inspection of all premises on which pigs are kept has been organized, and it is hoped that the disease will be confined to the present area. The present serious state has resulted through the failure of several owners who had been losing pigs over a considerable time to report the circumstances to the Department, with the result that the disease established a critical hold in the area involved.

The manner in which the infection reached Wellington is at present a mystery. Quarantine of imported pigs eliminates risk in this respect. When the danger through infected bacon or pork became recognized some three years ago, regulations controlling the destruction of garbage from overseas ships were gazetted, and the Department has since exercised a rigid control in that direction. No garbage has been allowed off any overseas ship in Wellington until the issue of a permit for its destruction. There are unfortunately, however, other possible avenues, such as the removal from overseas vessels of pork or bacon by persons visiting. It has been reported that this has actually occurred, people visiting ships being given bacon said to have been of Continental origin to take home and sample. Here is a vital potential danger. It is also possible for the infection to have reached Wellington on the personal belongings of people coming from Australia.

Co-operation for Control.

No effort will be spared by officers of the Live-stock Division to control the epidemic, but we must have the co-operation of all pig-breeders, and towards this end they are earnestly requested to advise the Department at once of any suspicious illness or deaths among their pigs. The matter, of course, most vitally affects the economic interests of pig-breeders themselves.

Animal and Human Nutrition.—In his recently published "Conspectus of Recent Agricultural Research" Lord Bledisloe remarks: "Reference to the beneficent work of the Plunket Society tempts the passing comment that if the average human being knew as much about the feeding of himself and his children as the average farmer knows about that of his stock, and especially about the requisite ratio of protein to starch in a well-balanced ration, the average standard of human health and physical energy would be at least 33 per cent. higher than it is. Probably as much as 50 per cent. of the therapeutic activities of physicians, druggists, and clinics is referable, directly or indirectly, to avoidable dietetic indiscretions based on ignorance of the fundamental principles of animal nutrition."

THE NORTH TARANAKI PASTURE COMPETITION.

REVIEW FOR SEASON 1932–33.

J. M. SMITH, Instructor in Agriculture, Fields Division, New Plymouth.

JUDGING of the farmers' pasture competition organized by a joint committee representing the Taranaki Agricultural Society and the Farmers' Union was completed in April. A new feature of the past season's operations was the judging at two seasons of the year—spring and autumn. Previously the pastures had been judged only in the spring, and it was felt that there was a definite weakness in this system. A good pasture should be one with an all the year round production capacity, whereas the best pasture in the spring might turn out to be one of the poorest in autumn.

As it happened, such a spring-like autumn was experienced this year that there was very little variation in the points allocated each pasture at the two judgings. An exception was in the lower Huirangi district, where an exceptionally dry February left the pastures in a very parched low-producing condition. In a normal season it is felt that pasture management will be a big feature of the autumn condition, although, naturally, pasture management must also be good in spring to secure the desired results.

Judging was again done by observation, and the scale of maximum points was as follows: Good grasses, 30; clovers, 25; freedom from inferior grasses, 5; freedom from weeds, 10; denseness of sward, 15; utilization and evenness of sward, 15—total, 100. This pointing appears to be fairly satisfactory, although it is practically impossible to get a scale of points entirely free from anomalies.

The "good grasses" in judging are principally perennial rye, cocksfoot, dogstail, timothy, controlled paspalum, and Poa trivialis. It is not sufficient that these species are merely present, but the individual plants must be strong-growing leafy specimens throwing a maximum amount of high-class herbage. Following this group of grasses are the Poa pratensis, Yorkshire fog type, which must command some respect as production species. In allocating points for clovers a suitable mixture of species should be included, the individual plants again being of good type. A definite weakness of our Taranaki swards in general is the amount of inferior or weed grasses that persist. These are principally sweet vernal and hair-grass, with a lesser amount of goose-grass, and are practically useless as butterfat producers.

The method of allocating points for freedom of weeds is fairly obvious, while those points for denseness of sward are extremely important. One might have a wonderful selection of grasses and clovers, but if only half of the ground is covered on account of very open sward then production must suffer. A little dissatisfaction exists in some quarters over the points for utilization, but this is an extremely important feature of pasture management. Grass wasting on a pasture is not only a direct loss, but a very

considerable indirect loss is caused by the damage done to the sward. Perhaps the most important phase of pasture management in spring is the control of growth.

Entries received for the past season's competition compared very favourably with those of the two preceding years, as follows :—

	1932–33.	1931–32.	1930–31.
Urenui	22	17	10
Inglewood	2	12	17
Huirangi	7	12	11
Kaimata	3	11	6
Lepperton	9	7	4
Tikorangi	7	10	2
Okato	5	16	..
Toko	8	5	..
Tarurutangi	8	8	..
Warea	..	4	..
Warehuia	16	..	..
Omata	4	..	..
Hurworth	2	..	..
Totals	93	102	50

Taking the pastures right through, the standard was exceptionally high. No doubt the wonderful season experienced had a lot to do with this, but at the same time it must be recognized that pasture management in Taranaki is reaching a high standard of efficiency. Farmers to-day appreciate the advantages to be derived from controlled grazing, even though it means bringing the mower into operation early in the season. A noticeable thing was how the well controlled swards kept a more even growth throughout the autumn months. The very favourable autumn experienced in most parts is indicated by the higher points awarded for the autumn judging in most cases. This is probably rather unusual, particularly in the coastal districts.

A weakness that has been very apparent in our Taranaki pastures—namely, deficiency in rye-grass—is gradually being overcome. In most cases this is being done by ploughing the paddock and resowing with certified rye, while in other cases surface-sowing of certified rye, following a severe harrowing or disking, is having the desired results. There should be no hesitation as to which method to adopt. If the paddock appears to be at all doubtful it should be ploughed and resown, but if there is a real good general sward, merely lacking in rye, surface-sowing should be adopted. At present prices there is no excuse for using other than certified rye-grass for permanent-pasture work. Timothy again upheld its reputation as one of the finest grasses for our districts of heavy rainfall. This grass is missed by the casual observer, as stock keep it closely grazed, but this fact alone indicates its worth. Cocksfoot is strong throughout, and was particularly noticeable where paddocks had been cut. Crested dogstail, that little-recognized and much abused stalwart of our grasslands, continues to keep the close and continuous sward which must be kept in the interests of high production.

Those paddocks, strong in paspalum, caused much interest (and a little concern to the judge) during autumn judging. Had the season been a dry one these paspalum swards would have

undoubtedly scored ahead of other pastures in autumn, but as it turned out the rye-grass and white clover associations were well maintained throughout the whole season, thus putting them ahead of the paspalum swards on the aggregate. Poa trivialis and meadow foxtail were noticed in a few swards, while subterranean clover promises well for seasonal growth.

Poa pratensis is very common throughout the dairying swards of the district—considerably to their detriment. Sweet vernal and flat weeds (catsear, rib-grass, hawkweed, &c.) also constitute far too great a part of our average Taranaki swards. Once these weeds are introduced it is a long uphill fight top-dressing them out on the straight cow-country, but with our present system of sowing down and with the introduction of sheep to the dairy-farm better results should be achieved in the future.

The Pastures and their Management.

One can assume that those farmers who enter pastures are either those who have good pastures or those who have fair pastures and wish to improve them; therefore one can take it for granted that the entries are those of the best type of pasture in North Taranaki, and are therefore an indication of sound methods, &c. A survey of the details which are supplied by each competitor (eighty-two actually supplied details) brings out the following points:—

Subdivision.—The average area of the paddocks judged was 6·2 acres, the individual sizes being—

15 acres	1	6 acres	12
10 to 15 acres	6	5 acres	16
9 acres	2	4 acres	13
8 acres	9	3 acres	10
7 acres	12		

These figures are an indication that subdivision is fairly well carried out, there being no unduly large paddocks. On the other hand, there are no unduly small paddocks, the size representing from eight to ten cows to the acre. This is a good feature brought into prominence by the competition.

Age of Pasture.—The average age of the pastures entered was 12·9 years, and the individual entries were—

45 years old	1	10 to 15 years	15
Over 20 years	25	7 to 10 years	13
15 to 20 years	6	3 to 7 years	22

It should be explained that no pasture under three years of age is eligible for entry. In a number of cases where the pasture was old the present owner did not really know the actual age, so that probably some of the pastures are actually older than indicated. Mention that the winning pasture was twenty years old, and that of the first ten placed pastures four were over twenty years old, and that another two were over ten years old, gives an indication that, in common with other districts, pastures in Taranaki will improve with age.

Time of Sowing.—This information was available in only fifty-two instances, the remainder of the pastures having been sown prior to the present owner's occupancy. Of these fifty-two, fifteen were sown in the spring and thirty-seven were autumn sown. Of

the spring-sown ones, twelve were in Central Taranaki (Wharehuia nine, Toko three), while twenty-nine of the autumn sowings were in coastal districts. This bears out the advice that while spring sowing is advantageous inland, autumn sowings give the best results on the coast.

Amount of Seed sown.—This opens up a controversial subject, and it is of moment to note that the average sowing from forty-six returns available was 44·2 lb. per acre. This is quite in accord with our impression that from a sowing of from 40 lb. to 45 lb. per acre of a suitable mixture good pastures can be obtained. Details of sowings are as follows :—

60 lb. to 65 lb. per acre ..	4	45 lb. to 49 lb. per acre ..	7
55 lb. to 59 lb. per acre ..	1	40 lb. to 44 lb. per acre ..	19
50 lb. to 54 lb. per acre ..	7	35 lb. to 39 lb. per acre ..	8

Manure sown with Seed.—In thirty-five cases out of forty-six manure was sown with the seed. It is quite common practice to put no manure with the seed, but to give an early top-dressing. While this may answer, a little manure with the seed will probably be an advantage. The manures used in this connection were as follows : Superphosphate, 19 ; bone, 3 ; superphosphate mixtures, 4 ; basic slag, 3 ; proprietary mixtures, 5 ; basic super, 1. This does not bear out the contention that a basic manure should be used so as not to damage germination. It would be an advantage to make more liberal use of bone, green bone, or even blood and bone in sowing down.

Subsequent Top-dressing.—Before dealing in detail with the various top-dressing fertilizers it should be pointed out that the pastures judged were spread over a large range of soils, from heavy river flats to light upland country. Therefore, while the top-dressing details of the competition are important, it is not suggested that the system followed by the successful or any other one competitor can be taken as the shining example of ideal manuring. Of more value is the indication given by the average use of any one manure or manure mixture, and the following tabulation is given to show the manuring treatment of all pastures entered over the last three seasons :—

	1930–31.	1931–32.	1932–33.
Basic slag	43	35	21
Superphosphate	11	16	23
Super and slag	4	4	4
Super and African phosphate..	2	1	..
Lime and super	1	2	19
Super and ammonia ..	3	4	3
Rock phosphates	3	5	..
Proprietary manures ..	2	1	2
Phosphate and potash ..	3	6	3
Super, bone, &c.	2	3	3
No manure	8	5	4

The first point of interest is the gradual swing from slag to super during the past three seasons, and no doubt prices are largely responsible for this. It is not suggested that slag has not continued to give good results, but no doubt limited finance in many cases tended towards the use of cheaper manure. This may in many ways be a blessing in disguise. The increase from 1 to 19

in three years in the users of the lime and super mixtures also shows the trend; no doubt at the present time this is a sound economical manure.

Quantities of Manure used.—The returns in this connection indicate that no unduly heavy quantities of manures were used; 9 cwt. per acre was the heaviest quantity, and this was used only in one instance. Details are as follows:—

	1930–31.	1931–32.	1932–33.
Over 6 cwt. per acre	1	..	..
„ 5 cwt. „	2	4	6
„ 4 cwt. „	6	10	8
„ 3 cwt. „	59	55	52
„ 2 cwt. „	6	8	12

This indicates that most farmers appear satisfied that 3 cwt. per acre is a sufficiently heavy dressing. It should be pointed out that in practically every case where over 3 cwt. was employed two dressings were made.

Harrowing.—The details under this heading show that the harrowing of grasslands in Taranaki is practically universal. While this is satisfactory in one respect, the number of times that the harrow is used could be increased considerably. In most instances tripods are employed, and as this harrow principally scatters droppings its more frequent application would result in the better utilization of this valuable form of fertilizing. In eleven cases out of eighty-two no harrowing was done.

The types of harrow used are as follows: Tripods (make not stated), 46; Perfect, 7; Whakatane, 6; heavy chains, 6; tynes, 3; Booth MacDonald, 2; home-made, 1.

The question of the degree of severity that should be practised in harrowing is an open question, but there is little doubt that in at least 95 per cent. of pastures in Taranaki much more severe harrowing could be practised at least once a year. In the other 5 per cent. of cases, where pastures are excellent, the degree of harrowing must vary. It is interesting to note, however, that the winning pasture was harrowed seven times (up to the autumn judging) with the Perfect harrow, a fairly severe grassland implement. The details of harrowing of the competing pastures are as follows:—

23 were given 1 stroke.	2 were given 5 strokes.
17 „ 2 strokes.	4 „ 6 „
16 „ 3 „	3 „ 7 „
6 „ 4 „	

The Winning Competitors and Pastures.

The pasture championship for the 1932–33 season was won by Mr. D. L. Tate, Urenui. In the preceding season this pasture was placed seventh on the list, so that it has probably improved considerably. The area of Mr. Tate's paddock is 7 acres; the pasture is at least twenty years old. No details of sowing are available, except that the paddock was autumn sowing. The top-dressing has been fairly complete over the past three years; in 1930 it consisted of 3 cwt. slag, 2 cwt. super and ammonia; in 1931, 2½ cwt. slag and 2½ cwt. ammoniated super; in 1932, 2½ cwt.

lime and super and 4 cwt. blood and bone and super (all quantities at per acre). The paddock has been well managed; five tripod harrowings were given. The judge's remarks at judging-time were as follows: "Nice balanced pasture; plenty of rye, dogstail, and clover in the spring, with rye, cocksfoot, timothy, and clover strong in the autumn, and with a nice sprinkling of paspalum through the sward. Very free from vernal, but a little Poa pratensis, while clovers lacked variety. Part of the paddock a little rough with paspalum."

Mr. F. Bracegirdle, Kaimata, and Mr. F. Goodin, Okato, tied for second place. Mr. Bracegirdle's paddock is 5 acres in extent, and was sown in the autumn fourteen years ago with 50 lb. of seed per acre. This pasture was a very thick one of a splendid mixture of grasses, but a little weak in clover in the spring. Mr. Goodin's pasture was one of the finest rye swards ever seen, but just lacked a little variety in species. Had the utilization been a little better in the spring it is possible that this pasture would have been placed first.

Mr. Bracegirdle's paddock received 4 cwt. slag and potash in 1930, the same dressing in 1931, and 4 cwt. slag in 1932; it also had two tripod harrowings in 1932. Mr. Goodin's top-dressing was 3 cwt. slag in each of the three years, and two harrowings with heavy chains were given in 1932. Mr. Bracegirdle's pasture was topped with the mower in 1930.

THE GRASS GRUB AND ITS CONTROL.*

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DURING recent seasons widespread and serious damage caused by the pest commonly known in New Zealand as the grass grub has attracted considerable attention. It has also led to the publication of statements involving misconceptions relative to the nature and control of the pest. Hence a brief account of the more important facts known about the pest will be useful for farmers and others.

The pest is an insect (*Odontria zealandica*) which for a long time has been known to cause much damage to important crops; because of this it has been much studied, and there is a good general knowledge of how it develops and lives, although, unfortunately, this knowledge is not fully complete. The pest passes through the normal changes in the life of insects.

In the adult stage the insect is a beetle, brown in colour with a darker margin to the wing cases. It is nocturnal in its habit, taking to flight at dusk and then giving out a droning noise peculiar to it. Large swarms appear during October, November, and December. Although the beetles may also be found in many other months, they are relatively few in number and of little practical importance in comparison with the swarms in the period centreing round November. At the end of their flight in the twilight the beetles settle upon and also feed upon the foliage of many plants. At times they do considerable damage by destroying

* Substance of an address broadcast from Radio Station 2YA, Wellington, May, 1933.

the leaves of orchard and ornamental plants, but the greatest direct damage due to them arises from the eating of the leaves of young turnip, swede, and rape crops. On the approach of daylight the beetles seek shelter in the denser foliage of plants or burrow into the ground. Stones, clods, and other objects on the surface of the ground also serve as shelter for them.

The weather at the times the beetles are about affects their operations. They are more active during calm dull evenings than on bright moonlight or windy nights. From this it is likely that the range of flight of beetles is affected by the weather conditions, and that in suitable weather they may move away from an infested area more readily than in unsuitable weather. This would account for the fact that in some fields the ravages of the grub may continue for at least three seasons, while in other fields the ravages may not continue for so long.

The economic importance of the leaf-eating activities of the beetle becomes clear when it is realized that these activities are the common cause of the ravages in New Zealand of the insect pest which is frequently called the "turnip-fly." One of the greatest obstacles to successful turnip-growing has been the destruction of the young plants in the seedling-leaf stage. Farmers commonly attribute this to the "turnip-fly." Many have assumed that the damage is caused by an insect which in Europe is given a similar name, and prior to about 1923 nothing definite had been established as to the identity of the insects causing the damage in New Zealand, but investigations completed about that time showed that the brown beetle (the adult stage of the grass grub) is responsible for much, if not all, of the insect activities attributed to the "fly." The beetle eats only those portions of plants which are above ground. The effect is greatest on crops which are in the seedling-leaf stage, for, in the case of such plants, both leaves and stalk may be removed, so that the individual plants are destroyed. An equal amount of material might be removed from more advanced plants and yet result in sufficient of the plants remaining to allow of eventual recovery, even though they suffer a severe set-back.

Although turnips and allied crops probably suffer most from the ravages of the beetle, other crops in the seedling-leaf stage during the flight of the beetle are liable to damage. Normally, the beetle either destroys a crop wholly or completely destroys patches of it, leaving other patches relatively unharmed. Because of this feature it is impracticable to resort to the use of heavier amounts of seed in order to allow for some of the seedlings being destroyed by the beetles.

The females brown beetle lays eggs at or near the surface of the ground, generally at the base of plants. Laying is likely to take place during the whole period that the adult beetles are about, chiefly from the end of October to the end of December. In general the main laying of eggs takes place between the first week in November and the first week in December. This fact is a basic consideration in the avoidance of infestation of ground by the grubs in districts in which the grub is known to be of common occurrence. If land is bare of vegetation during this period it is

very unlikely that beetles will deposit any material number of eggs on it, and crops growing on land on which eggs have not been deposited will not suffer from damage from grubs during the following year. It would allow of more satisfactory control if the emergence of the beetles took place at the same date every year, but it varies to some extent, bad feeding conditions for the grubs being one of the causes of delay in their attaining the beetle stage.

The eggs laid by the beetles have been found to hatch out in from nine to eleven days into grubs which feed on the roots of plants, especially those of the fibrous nature that is found in the roots of grasses. The grubs also feed on many tap-rooted plants; indeed, when its roots are young, as in the seedling stage, any type of plant, including forest trees, is apt to be destroyed. During November a few young grubs may be found active just beneath the surface of the soil. From December to April or May they are markedly active; they are growing, being nourished by the roots they consume in the surface layer of soil. When the cold weather comes they cease feeding and burrow downward to a depth of 1 ft. or more if the soil is light, and here they stay until about August, when warm conditions are about to return again.

During August and September the grubs continue to feed and grow, but in September they usually begin to leave off feeding, and by the end of September practically all of them have gone into a resting-stage from which they eventually emerge as beetles at the time previously mentioned.

The grubs are creamy-white in colour, except for a brownish head. They lie in the ground doubled up in the form of the letter U. They pass a large quantity of earth mixed with food through their bodies, and when present in large numbers the grubs, as a result of this, thoroughly pulverize the soil.

The facts just mentioned regarding the life of the grass grub are the main ones upon which methods of control are based. The two critical facts in formulating means of control are, firstly, that the main swarm of beetles and the main egg-laying occur in November and early December; and, secondly, that the grubs busily eat suitable roots in the surface layer of the soil, and thereby injure crops during the period December to April or May, and again in August and early September.

While a number of valuable means of minimizing grass-grub ravages are known, there have not as yet been evolved any satisfactory practicable means of directly destroying grubs on a farming scale. The main control measures are indirect. They aim either to avoid practices or conditions which favour grub attacks or to introduce conditions which will enable attacked plants to recover from their injuries.

Specific Measures of Control.

The following are the main measures of value in minimizing the ravages of the grub :—

(1) FEEDING OF HAY, ETC., ON INFESTED AREAS.

The feeding-out of hay, roots, and other fooder should be concentrated as far as possible on areas known to be infested with

grubs. Under dry loose conditions plants the roots of which have been destroyed by the grubs cannot readily develop new roots, whereas the consolidation which is caused by the trampling of feeding stock restores the rise of soil water from the lower layers to the surface layer where it is needed to facilitate root renewal. In addition, the firming of the soil is probably not favourable to the grubs themselves, and so will bring lessened activity on their part.

Further, the feeding-out of hay is likely to bring about the surface-sowing of an appreciable amount of seed of useful pasture species which, becoming established, replace some of the valuable plants that were previously destroyed, and so tend to restore to some extent the density of the sward.

(2) TOP-DRESSING WHICH FOSTERS INCREASED VIGOUR OF SWARD.

Suitable top-dressing frequently would prove of value. Judicious top-dressing serves to build up the vigour of the plants, and the additional vigour enables injured plants more quickly to develop new roots and thereby to survive. Usually a phosphatic dressing is of value. On swards which are known to benefit from other top-dressing materials these are likely to reduce the ravages of the grub. Grass grubs are practically always present in grassland. Whether they cause serious damage seems to depend largely on the dryness of the soil and on its fertility. On rich moist soil a pasture could support, without dying out, a number of grubs which would cause serious injury to a similar sward under drier and less fertile conditions. The amount of injury to the pasture is governed by the capacity of injured plants to effect recovery.

Top-dressing will frequently increase this capacity, especially when it is linked with consolidation, which will give an improved supply of moisture to the surface layer of soil. Under dry conditions the capacity of injured plants to recover is reduced. And so the ravages of the grub are more in evidence in dry climates, and in dry seasons in districts usually favoured with moist seasons. The joint cultivating consolidating effect of the hoof is more valuable in grass-grub control than any result obtained by mechanical means. The hoof cultivation is best brought about when the grubs are active in the surface layer. Hence the feeding-out of hay and other fodders when they are normally required by the stock in winter and early spring fits in well for the purpose of lessening the damage done by the grubs.

(3) PROVISION OF CONDITIONS UNFAVOURABLE TO INFESTATION.

Special efforts should be made to turn to practical use the fact that the laying of the eggs which hatch into the grubs does not commonly take place on ground which is bare of vegetation during the time the main swarm of beetles is about. In a locality in which the grass grub is known to occur freely fresh infestation of a field is not likely to occur to a serious extent if that field is practically free from pasture or other crops in November and early December. On the one hand, cereals or grass sown in the spring are prone to suffer seriously from grubs which hatch from eggs

deposited in the shelter of the young crop in November or December. On the other hand, grass sown with rape so that the land is virtually bare at the time the main egg-laying takes place is normally much less subject to grass-grub damage in its first year when, because of the relatively loose condition of the soil, grubs could display most activity. Hence, in districts in which grass grub is usually prevalent, if pastures are to be sown with a companion crop, that crop should, as far as possible, be rape or turnips sown at a date which leaves the ground relatively bare during the laying of eggs by the beetles, rather than with a spring-sown cereal which provides abundant cover that attracts egg-laying beetles.

The matters just considered indicate to some extent what should be done with badly infested grassland which it is intended to crop. To avoid further egg-laying on it such land should be cultivated in late spring and kept bare until the autumn, when it can be sown with a cereal. And if it is necessary to crop the land the same season that it is ploughed, crops sown on it in late October should generally escape subsequent serious grub injury, for such crops will leave the land practically devoid of cover for the beetles in November and early December.

The main crops available for such sowing are summer special forage crops, linseed, and, in the North Island, possibly barley. Stubble land is often badly infected from the egg-laying which took place in the previous November, and much stubble land is a difficult proposition. If it is desired to follow a cereal with another cereal, the second cereal crop should be sown very late in the autumn or not until the spring. Winter wheat followed by spring-sown oats is a satisfactory possibility, but grass should not be sown with such oats.

Fresh grub infestation of pastures is considered to be minimized as a rule by keeping the growth uniformly short during the period of the year when egg-laying occurs. This calls for suitable summer-grazing management of pastures of such a kind as often may be most readily obtained by fully exploiting early ensilage. Adequate early ensilage will result not only in a desirably short condition of the fields which are under grazing, but also in a short growth of vegetation, at times, on the fields from which silage has already been saved before the main egg-laying occurs. It is known that egg-laying and consequent grub infestation occur at times even on fields which have been kept as short as possible, so that freedom from ravage of the grubs cannot be assured by suitable summer management alone, but such management is nevertheless considered of value as a means of reducing the likelihood of severe damage.

(4) ADJUSTING CROP DEVELOPMENT TO AVOID RAVAGES OF THE "FLY."

Control of the "fly" damage of the beetle on seedling crops in November resolves itself into arranging the date of sowing so as not to have the crops in their early stages, particularly the two-leaf stage, when the main swarm of beetles may be expected. Sowings made in October are likely to be advanced enough to escape serious

injury later, and crops sown from the last week in December onwards are also likely to be safe, although subject to attacks from beetles of late appearance.

(5) LIMITED VALUE OF CHEMICAL CONTROL.

Although chemical control is not practicable on a farm scale it has been shown in recent work by Mr. W. Cottier, of the Plant Research Station, to be of considerable value in controlling the grub in lawns. For this purpose arsenate of lead powder as used for spraying fruit trees has, so far, been found to be satisfactory, and an outlay on this material at the rate of about 6s. per 1,000 sq. ft. of lawn has been found to obviate grub ravages probably for at least three years.

The following statement relative to the use of arsenate of lead has been supplied by Mr. Cottier: "The treatment is to broadcast evenly 5 lb. of powdered arsenate of lead over 1,000 sq. ft. of lawn surface. To allow easier distribution the arsenate should be thoroughly mixed with twice its volume of damp (not wet) sand or sieved soil. After application rake the dressing into the turf off the grass leaves as much as possible. In cases of poorly nourished grass a yellow discoloration may be visible after a few weeks, but this can be easily overcome by adequate manuring, such as the application of sulphate of ammonia at not more than 2 cwt. per acre, a month after treatment with arsenate. Manures very high in phosphoric acid are not desirable." Further information regarding the method of using the arsenate of lead for this purpose may be obtained by applying to the Department of Agriculture.

Sulphur and lime have been found to be quite ineffective as practical means of controlling the grub, and there is no evidence that salt would be of economic value nor any grounds for expecting it to be so.

CONTROL MEASURES SUMMARIZED.

On a farm scale the control of the grass grub resolves itself into:—

(1) Making conditions unattractive for egg-laying by arranging to have land as bare of vegetation as possible in November and early December. This means that arable crops and young pastures should not be far enough forward to provide appreciable cover, that established pastures should be kept as short as possible during this period, and that the sowing of arable land should take place at a time which will give little or no time for the development of vegetation.

(2) Conditions should be as good as possible for the recovery of injured crops. In this connection appropriate top-dressing and consolidation by trampling are of known value. To obtain the maximum effect from trampling it is advisable usually to concentrate feeding-out of hay, &c., on to those areas in which grub infestation is most severe.

(3) Various dressings such as lime, sulphur, and salt are not recommended, but arsenate of lead is recommended for use on lawns.

INVESTIGATIONS IN PASTURE-PRODUCTION.

IV. THE EFFECT OF USING NITROGEN AND POTASH AS ADJUNCTS TO SUPERPHOSPHATE, AND A COMPARISON OF TWO "CONCENTRATED" FERTILIZERS WITH SIMPLE MIXTURES.

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A FULL report on this investigation, which was carried out at the Marton Experimental Area, will be published shortly as Part IV of Bulletin No. 31, Department of Scientific and Industrial Research. A general outline of the investigation and the main features of the results for a period of three years are here presented.

The object of the experiment is indicated in the title to this article, the treatments used per acre each year being as follows:—

(1) No fertilizer.
(2) Superphosphate (44/46 per cent. tricalcic phosphate) 4 cwt.
(3) Super 4 cwt. plus sulphate of ammonia 4 cwt.
(4) Leunaphos 462 lb.
(5) Super 4 cwt. plus sulphate of ammonia 4 cwt. plus muriate of potash 220 lb.
(6) Nitrophoska 560 lb.

NOTE.—Leunaphos is a concentrated fertilizer sold as containing 20 per cent. of nitrogen and 20 per cent. of phosphoric anhydride. Nitrophoska is a concentrated fertilizer sold as containing 16·5 per cent. of nitrogen, 16·5 per cent. of phosphoric anhydride, and 20 per cent. of potash.

The quantities were designed so that Treatments 2 to 6 inclusive each received the same amount of phosphate, Treatments 3 to 6 inclusive each received the same amount of nitrogen, and Treatments 5 and 6 the same amount of potash.

Following on the European practice in the use of nitrogen, fertilizers were applied three times a year. Strict comparison with the concentrated fertilizers necessitated the distributed applications of phosphate and potash along with those of nitrogen.

Two hundredweights of super, 2 cwt. of sulphate of ammonia, and 110 lb. of muriate of potash, where each or all were used, or the equivalents in Leunaphos or Nitrophoska, were applied in the early spring about late July or early August. A second dressing of half these quantities was applied in the summer (December or January), and the third, similar in amount to the summer one, was applied in March or April. Eight hundredweights of ground limestone was applied to all plots each year.

Production was measured by cutting with a lawn-mower under the system of "alternate mowing and grazing" described in Part I of this series of articles (see *Journal* for August, 1931). The technique was as outlined in Part I, there being twelve replications of each treatment in each of duplicate areas, giving a total of twenty-four replications from which yields were determined. The technique ensured the pasture being kept under conditions comparable with those of intensive rotational grazing.

The yields from forty-two successive growths of the pasture were determined during the three years reviewed. For the sake of convenience and brevity, yields and increases in yield due to treatments are expressed in pounds per acre of green herbage. Dry-matter determinations were carried out during the last two years of the trial, and show that herbage from plots receiving fertilizer usually contained a slightly lower percentage of dry matter than herbage from the no-fertilizer treatments. Hence increases expressed as green herbage, more especially those due to superphosphate, are a little higher than would be the case if they were expressed in terms of dry matter.

The weight in pounds per acre of green herbage to the nearest 100 lb. from Treatment 1 (no fertilizer) for each of the three years were as follows :—

1929–30.	1930–31.	1931–32.
19,100 lb.	22,800 lb.	26,700 lb.

The improvement in production as the trial progressed is discussed fully in Bulletin No. 31, and is due to a number of factors, chief of which are considered to be the effect of the system of management and the annual lime dressing of 8 cwt. per acre.

The increased yields and percentage increases over no fertilizer, due to superphosphate, are as follows :—

1929–30.	1930–31.	1931–32.
5,700 lb.	8,300 lb.	7,000 lb.
30 per cent.*	36 per cent.	26 per cent.

* Based on increases to nearest pound throughout article.

The increase in the third season, although actually greater than in the first, shows as a lower *percentage* increase because of the greater yield of the no-fertilizer treatment in the third season compared with the first.

Sulphate of ammonia added to super caused further increases in yield. These are shown as the increases of Treatment 3 (super plus sulphate of ammonia) over Treatment 2 (super).

1929–30.	1930–31.	1931–32.
4,000 lb.	3,100 lb.	2,900 lb.
16 per cent.	10 per cent.	9 per cent.

A marked reduction in effect from sulphate of ammonia is apparent in the second season compared with the first. A further slight reduction occurred in the third season, during which production from plots treated with sulphate of ammonia "slumped" below that from super-treated plots for about six or seven weeks in December and January. This slumping in production coincided with noticeable reduction in the amount of white clover due to the sulphate of ammonia treatment.

Leunaphos produced 200, 200, and 1,000 lb. per acre more than the equivalent super plus sulphate of ammonia (Treatment 3) in the first, second, and third seasons respectively. The differences in the first two seasons are negligible, but the third season's difference is appreciable, and is due chiefly to the fact that the Leunaphos plots did not slump in production when super plus sulphate of ammonia did so.

Potash was not strikingly effective, the Marton soil showing only a slight response to potash. The increases of Treatment 5 (super

plus sulphate of ammonia plus muriate of potash) over Treatment 3 (super plus sulphate of ammonia) were :—

1929–30.	1930–31.	1931–32.
2,100 lb.	1,500 lb.	2,500 lb.
7 per cent.	4 per cent.	7 per cent.

Nitrophoska (Treatment 6) proved to be inferior in its effect to the equivalent mixture of super plus sulphate of ammonia plus muriate of potash (Treatment 5), the differences in favour of the latter being 1,600, 200, and 800 lb. per acre of green herbage for the 1929–30, 1930–31, and 1931–32 seasons respectively.

The summer applications of nitrogen made in December or January were the least effective of the three applications each year. All plots receiving nitrogen (Treatments 3, 4, 5, and 6) exhibited a reduction in white clover content of the pasture during the late summer months. Leunaphos and Nitrophoska were only slightly affected in this respect, the reduction being most marked on plots receiving sulphate of ammonia. The nitrogen-treated plots contained definitely fewer weeds, such as catsear and rib-grass, than the super and no-fertilizer plots. The no-fertilizer plots contained most weeds and most bare ground.

For a part of the first and during the whole of the second and third years under review herbage from Treatments 1, 2, 3, and 5 was analysed from each growth. The salient features of these analyses were as follows :—

(1) Lime content : The lime content of the herbage from superphosphate plots (Treatment 2) was higher than that from other treatments throughout the whole of the two-year period except on two occasions. The total lime as a percentage of the total dry matter in the herbage from the treatments specified during a period of just over two years shows the following results :—

No Fertilizer.	Super.	Super plus Sulphate of Ammonia.	Super plus Sulphate of Ammonia plus Muriate of Potash.
0·96 per cent.	1·02 per cent.	0·95 per cent.	0·92 per cent.

(2) Phosphate (P_2O_5) content : All of Treatments 2, 3, and 5 increased the phosphate content of the herbage appreciably. This effect must be attributed to the superphosphate. The values for the total phosphoric anhydride (P_2O_5) as percentages of the total dry matter for just over two years were as follows :—

No Fertilizer.	Super.	Super plus Sulphate of Ammonia.	Super plus Sulphate of Ammonia plus Muriate of Potash.
0·80 per cent.	1·00 per cent.	0·98 per cent.	0·98 per cent.

(3) Potash (K_2O) content : The most marked feature of the effect of the treatments in the potash content of the herbage is an increase due to the application of potash. The total potash (K_2O) as a percentage of the total yield of dry matter from each treatment resulted as follows :—

No Fertilizer.	Super.	Super plus Sulphate of Ammonia.	Super plus Sulphate of Ammonia plus Muriate of Potash.
2·34 per cent.	2·31 per cent.	2·32 per cent.	3·00 per cent.

What significance an increase in the potash content of the herbage may have it is impossible to say. This point is discussed more fully in Bulletin 31.

(4) Nitrogen content: All of Treatments 2, 3, and 5 increased the nitrogen and hence the protein content of the herbage over the period as a whole. Since Treatments 3 and 5 show no general superiority over Treatment 2 (super) the increase in nitrogen content must be attributed to the superphosphate. The values for the total nitrogen as percentages of the total dry matter for just over two years were as follows:—

No Fertilizer.	Super.	Super plus Sulphate of Ammonia.	Super plus Sulphate of Ammonia plus Muriate of Potash.
4·04 per cent.	4·27 per cent.	4·27 per cent.	4·21 per cent.

(5) The fat, fibre, and nitrogen-free extractives did not vary markedly as a result of the treatments applied.

Soil samples taken at the end of the three-year period show that no fertilizer and super (Treatments 1 and 2) were the same in degree of soil acidity. Treatments 3, 4, 5, and 6 were more acid, Treatment 3 (super plus sulphate of ammonia) being worst in this respect. Actually the lime applied reduced the acidity from what it was at the commencement of the trial, this effect being least marked on the plots receiving the fertilizers sulphate of ammonia, Leunaphos, and Nitrophoska, all of which increase soil acidity if lime is not used to counteract their effect.

FLEABANE AND SEA ASTER.

THEIR IDENTIFICATION AND INCIDENCE IN TIDAL-LAND RECLAMATION.

H. H. ALLAN, Plant Research Station, Palmerston North.

THE two plants here dealt with are rather closely related botanically, but are very distinct in appearance. As both are of some importance on reclaimed land in the Auckland Province the present article is written to clear up a certain amount of confusion that has arisen concerning the names to be applied to them.

Fleabane (*Erigeron canadensis*) is a native of North America, but has become a very common waste-land weed in most parts of the world. Numerous popular names have been given to it—*e.g.*, horse-weed, butter-weed, fireweed, bitter-weed—but it is most generally known as fleabane or Canadian fleabane. It was a very early immigrant to New Zealand, and was recorded by Hooker in 1867. By 1882 it was plentiful throughout the Auckland District, and is now common all through both North and South Islands, except in parts of Otago and Southland. It is rejected by stock, and is to be classed as a weed, though usually a comparatively harmless one. It derives its name of fleabane from the volatile oil it possesses. This oil has an acrid taste, and in some persons causes an irritation when the plant is handled. The leaves are bitter, and the plant is objectionable if occurring in any quantity in hay. Stock-poisoning has been suspected, but, fortunately, stock seldom touch the plant. The distilled oil is used to some extent in medicine and as a deterrent to mosquitoes.

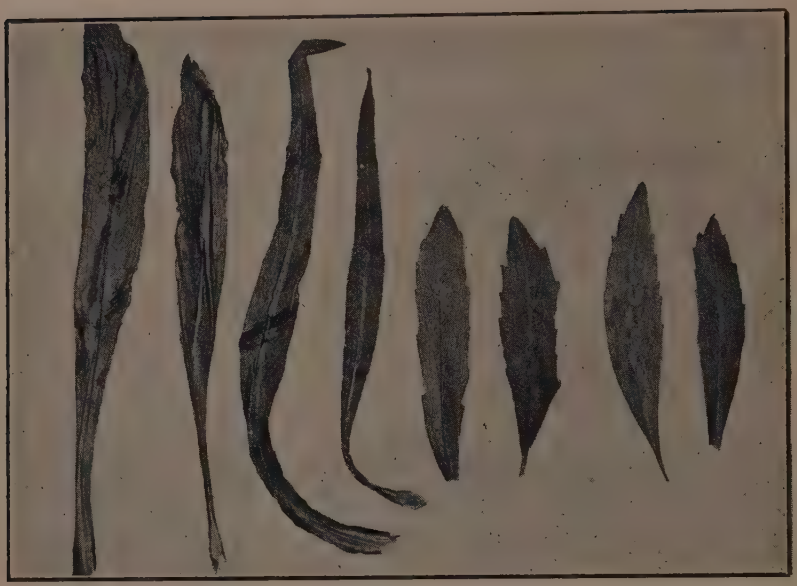


FIG. 1. RIGHT: LOWER LEAVES OF FLEABANE. LEFT: LOWER LEAVES OF SEA ASTER.

[*Photo by H. Drake.*

Sea aster (*Aster subulatus*) is a native of the salt marshes along the American coast from New Brunswick to Florida, and in American literature is sometimes referred to as "annual salt-marsh aster." Cheeseman, writing in 1919, said: "This plant was first noticed in the vicinity of Auckland about twelve years ago, and soon became plentiful, especially in moist places on harbour reclamations, by roadsides and ditches, &c." It now occurs on many salt-swamps and recently reclaimed land throughout the Auckland Province, and is often found in great abundance. It is very well liked by cattle, and has been found to have good fattening qualities, so that it must be regarded as a very useful plant in the habitats it prefers. Unfortunately, although very different in appearance and properties from *Erigeron canadensis*, it has become known to many in the North as "fleabane," so that there is often doubt as to which plant is being referred to when "fleabane" is spoken of. This is doubly unfortunate, as both *Aster subulatus* and *Erigeron canadensis* are important indicators of the state of the reclaimed land, and their presence or absence has an important bearing on the treatment to be given. I quote later a communication received from Mr. C. J. Hamblyn, Instructor in Agriculture, Whangarei, which shows the importance of a knowledge of the two plants. It seems well, also, to present a description of the two, and to attempt to fix the popular names to be applied to each.

Botanical Description.

Erigeron canadensis (Fleabane): An annual, with erect, rather wand-like, finely grooved, *bristly-hairy stems*. On good soil it may

reach as much as 10 ft., but on poor soil may flower when only a few inches high. When cut it stools freely, assuming a bushy habit. The lower leaves are about 3 in. long and up to ¾ in. wide, the widest part being above the middle. They are *rough to the touch*, owing to the bristle-like hairs, and usually show several distinct, distant teeth along the margins. The upper leaves are much narrower, usually lacking teeth, and produced in abundance. The flower-heads are very small and very numerous, more or less clustered on branching stems from among the upper leaves. The very small white rays can be seen only on close inspection. The seeds are very numerous—an average plant produces over 100,000—and provided with a small plume of yellowish brown hairs.

Aster subulatus (Sea aster): An annual, with *quite smooth stems and leaves*, free from hairs. The plant seldom reaches more than 3 ft., about 15 in. being the average height. The lower leaves may be up to 8 in. long and ¾ in. wide, slightly fleshy and *smooth to the touch*, becoming thin when dry. The margins may be somewhat wavy, but lack distinct teeth. The upper leaves are shorter

FIG. 2. LEFT: INFLORESCENCE OF FLEABANE. RIGHT: INFLORESCENCE OF SEA ASTER.

[*Photo by H. Drake.*

and very narrow, widest near the bases. The branched inflorescence is more spreading and open than that of fleabane. The flower-heads are purplish in the centre, and the white rays are usually more distinct than in fleabane. The plume of the seeds is more nearly white.

Whereas the sea aster grows mainly on the recently reclaimed still quite salt flats, the fleabane grows on the higher parts, and does not invade the flats till the salt-content is much less. Fleabane is also a common wasteland and roadside plant, a situation that is not occupied by sea aster.

North Auckland Experience in connection with Reclamation.

Mr. Hamblyn writes:—

Farmers on the Northern Wairoa, Hokianga Harbour, Whangaroa Harbour, and elsewhere, who have had experience of the reclamation of tidal lands, recognize the difference between the two plants and refer to *Aster subulatus* as "fleabane" and to *Erigeron canadensis* generally as "fireweed." The aster is credited with excellent feeding and fattening qualities, and is, in my opinion, relished by cattle. Whereas the aster will rapidly become general over the reclaimed area so soon as the salt content of the surface is reduced slightly, the Erigeron comes in first along the edges of drains, on drain-banks and stop-banks, and on any places above the general level of the tidal flat which are better drained than the rest. Erigeron does not become general until the land is well enough drained and free from salt to take grass well.

Though the aster may be taken as an indication that the soil conditions are improving, it is my experience that the aster will thrive when the salt content of the soil is such that neither rye-grass nor white clover will establish and even strawberry clover finds conditions not altogether suitable. On the other hand, where the Erigeron establishes, white clover and rye can be grown satisfactorily. I am of the opinion that much time and money would be saved in grassing tidal flats if the following sequence were recognized and internal drainage put in soon after stop-banking to bring about the succession quicker.

On Salicornia flats, when stop-banked only, the Salicornia continues to grow for two or three years or more and is gradually replaced by fleabane (*Aster subulatus*). In from five to six years, or even more, Erigeron will gradually come in, and when it is well established, but not till then, white clover and perennial rye can be established. In the fleabane stage, paspalum, strawberry clover, and Lotus major can be established, but it is not till the Erigeron stage is reached that even these will thrive and spread to form a sward.

On mangrove flats, with stop-banking only, the mangrove dies slowly, taking from two to three years; fleabane by this time is becoming established and in the next two years will cover the area, with Erigeron close round the big mangroves and on the banks and along the drains. It generally takes several more years for Erigeron to displace fleabane generally, and until it does pasture establishment is again very slow. The succession in both cases can be hastened to a very marked extent by putting in open or, better still, fascine drains across the flats every 1 or 2 chains apart, according to the type of soil.

The general establishment of *Erigeron canadensis* is, to my experience, a much surer indicator of suitable conditions for grass establishment than is the aster.

SUPPLY OF PHOSPHATES TO STOCK THROUGH THE DRINKING-WATER.

B. C. ASTON, Chief Chemist, Department of Agriculture.

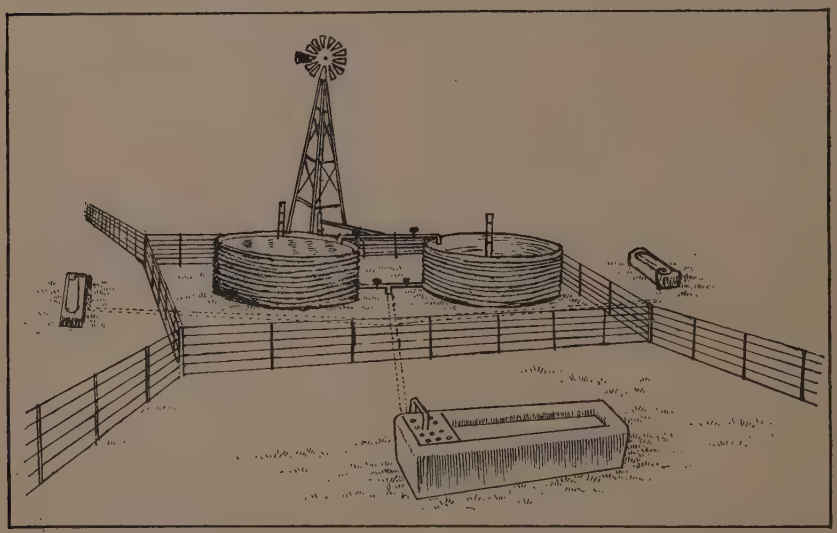
THE method of giving mineral foods to stock through the drinking-water has been receiving the attention of the South African Department of Agriculture. In the extensive pastoral regions of the Union generally there is a great deficiency of phosphates in the natural pasture at all times, but when the droughty months of winter arrive deficiency becomes greatly accentuated. This is well shown in Dr. Orr's "Minerals in Pastures," where two instances are given showing progressive diminution of phosphate from 0·6 per cent. in November to 0·09 per cent. in June, and from 0·65 per cent. to 0·04 per cent. over the same period. It will be readily seen that cattle would suffer from deficiency when fed on a grass containing such a small amount of phosphoric acid as the winter pasture contains in South Africa. Top-dressing with phosphates being impracticable in the areas referred to, the technique of administering the requisite phosphate in a solution of the drinking-water has been fully worked out, as shown in the accompanying sketch taken from a recent publication of the South African Department.

The phosphates used were disodium phosphate (Na_2HPO_4), 20 per cent. of phosphoric acid (P_2O_5), and mono-ammonium phosphate ($NH_4H_2PO_4$) containing 56 per cent. of phosphoric acid (P_2O_5), and costing £10 per ton. The drinking-water method was tried in an endeavour to cheapen the expensive method of giving bonedust as a dosage to stock to counteract phosphorus deficiency. The experiments, described by Bekker, were completely successful in saving labour, in handling and dosage, and in avoiding the daily mustering of stock. The animals regulate the phosphorus they require better in the drinking-water method than by dosage by hand. More of the phosphate is utilized from the soluble salt than from bones. Hence the cost of the treatment is greatly reduced when compared with the dosage by giving bonedust. The supply of drinking-water itself is improved by adopting this method.

Where an abundance of natural water occurs the method is not practicable. This is a serious drawback to adopting the principle in New Zealand, where the supplies of drinking-water are so abundant from creeks, rivers, and temporary standing water that it is often impossible to induce cattle to drink from troughs. There must, however, be many places where the supply of water to cattle is under complete control by means of a reticulated supply from reservoirs, and it is to these that the system of adding superphosphate or any soluble phosphate to the drinking-water could be easily and cheaply arranged.

The amount found successful at the Mamaku Demonstration Farm (near Rotorua), where the only interfering factor is that of occasional puddles after heavy rain, there being no creeks or standing water over the greater part of the plateau, is 1 lb. of

ordinary superphosphate to 100 gallons of water. It is to be noted that the kind of superphosphate recommended is that made entirely from Nauru and Ocean Island phosphates, as these contain no fluorides. These are inimical compounds to give to animals regularly, because, although insoluble in water, they may possibly remain suspended long enough to be taken up with the soluble phosphate. The South African authorities, du Toit and Malan, stress the fact that South African supplies of superphosphate and rock phosphate contain so much fluorine that they are definitely harmful to animals in the proportions which would be used as



METHOD OF SUPPLYING WATER-SOLUBLE PHOSPHATES TO STOCK IN THEIR DRINKING-WATER.

The windmill can be made to pump water into either of the two tanks. When one tank is full the phosphate solution is made up. The tank is then connected with the drinking-troughs so that these remain full. When the tank containing the phosphate solution is empty a fresh solution is made up in the other tank, which is then connected with the troughs, the first tank being disconnected and refilled by the windmill.

[*After Bekker.*

licks. They show photographs of practical experiments on cattle exhibiting progressive ill effects with increasing dosage of fluorides in the licks ("Farming in South Africa," December, 1932, p. 387).

Evidently in New Zealand, where the use of licks is increasing, care must be taken to choose the source of the phosphate used, so that any mineral with a high fluorine content is not used. The outcome of the South African investigators' work seems to point to precipitated phosphate (dicalcic phosphate) and bonedust as being the best source for licks, and a soluble phosphate such as sodium or ammonium phosphate or superphosphate for use in the drinking-water.

IMPORTATION OF FERTILIZERS IN 1932–33.

Chemistry Section, Department of Agriculture, Wellington.

THE fertilizer and fertilizer materials importation figures supplied by courtesy of the Comptroller of Customs for the year ended 31st March, 1933, taken as a whole show a considerable increase over the preceding year's total imports, and are above those of the year 1930–31. Nevertheless, in the main they are still well below those of 1929–30, the peak year of fertilizer importations. In the appended tables will be found the summary of all importations of fertilizer for the past year.

Phosphates.—The continued rise in imports of raw phosphate from Nauru and Ocean Islands is reflected in an increased production of superphosphate within the Dominion; 188,388 tons of the raw island phosphate were imported, which represents about 27 per cent. more than the 1931–32 quota. The Government subsidy of 12s. per ton on high-grade 20-per-cent. superphosphate produced in this country is no doubt responsible for the use of increased quantities of Nauru/Ocean Islands phosphate, as this material is chiefly converted into superphosphate. Supplies of phosphate from other sources in the Pacific and Indian Oceans, such as Seychelles, Tuamotu Archipelago, and New Caledonia, show a decrease of about 14 per cent. on the preceding year's figures. It will be noted that there was no importation of superphosphate during the past year.

Some 6,000 tons of phosphate, an increase of 27 per cent. compared with last year, were imported from Belgium, Great Britain, and the Netherlands, the greater portion—4,500 tons—coming from Belgium, where raw phosphate shipped from North African mines is very finely ground and re-exported. No phosphate is reported as being shipped direct to New Zealand ports from Northern Africa as was customary some years ago. A small amount (160 tons) of Egyptian phosphate has been reintroduced, the last imports of such material being in 1929–30, when 1,000 tons were imported.

The figures for basic slag are interesting, for, despite the general shortage of supplies on European markets and the subsidized competition from locally manufactured superphosphate, also the adverse exchange affecting the selling-price of slag, over 42,000 tons were imported during the period under review, or only 12 per cent. less than in the previous year. Great Britain again supplied about one-fifth of the total imports, so it would seem that the British article is now definitely established on the local market.

Nitrogen.—Increases in the importations of nitrogenous fertilizers, such as synthetic sulphate of ammonia and Chilean nitrate of soda, are manifested in the year's returns, the former having increased by almost 43 per cent., while imports of the latter were more than doubled. Altogether imports of nitrogenous fertilizers, amounting to 8,702 tons, have risen nearly 53 per cent. during the past year.

Due allowance must, however, be made for nitrate of soda, which is employed to some extent in chemical manufacture and not for fertilizing purposes only.

Potash.—A further slight decline in the total quantity of all potash fertilizers imported is again evidenced in this year's return, which shows a total of 4,144 tons compared with 4,628 tons in 1931–32.

TABLE 1.—SUMMARY OF FERTILIZER IMPORTATIONS, 1932–33 AND 1931–32.

Fertilizer.	Quantity.		Declared Value.*	
	Year 1932–33.	Year 1931–32	Year 1932–33.	Year 1931–32.
	Tons.	Tons.	£	£
Bonedust and bone-char ..	30†	180	96	993
Basic slag	42,022	47,776	104,902	119,191
Superphosphate (concentrated) ..	..	300	..	2,014
Nauru and Ocean Islands phosphate	188,388	148,060	244,293	198,842
Island phosphate (other)‡ ..	26,057	30,406	46,788	44,800
Egyptian phosphate	160	..	578	..
Phosphate (not otherwise specified)§	6,024	4,738	14,988	12,378
Kainit	785	334	2,850	971
Muriate of potash	155	65	1,757	844
Sulphate of potash	682	648	9,553	6,867
Potash salts (other)	2,522	3,581	15,069	16,480
Sulphate of ammonia	6,840	4,785	40,821	38,160
Nitrate of soda	1,862	920	19,334	7,915
Cyanamide	5	..	38	..
Sulphate of iron	7	45	45	233
Fertilizers unspecified	51	5	472	101
Totals	275,590	241,843	501,584	449,789

* The values shown are those declared for Customs purposes only, and represent the current domestic values in the countries of exportation, plus 10 per cent. † Bone-char. ‡ Includes phosphate from Tuamotu Archipelago, Seychelles Islands, and New Caledonia (for details see Table 3). § Chiefly from Belgium—presumably North African phosphate ground in Belgium and re-exported.

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1924–33.

Year ended 31st March,	Bonedust and Bone-char.	Basic Slag.	Super-phosphate.	Pacific and Indian Oceans Phosphate.	Egyptian Phosphate.	Moroccan Phosphate.	North African Phosphate (other).
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1924 ..	4,158	39,632	255	76,517	5,996	..	..
1925 ..	2,452	45,682	10	108,163	8,530	..	..
1926 ..	2,085	44,314	500	97,488	10,037	..	..
1927 ..	1,805	53,327	15	161,541	5,979	..	..
1928 ..	725	48,913	6,616	143,373	6,603	13,389	..
1929 ..	554	93,222	1,037	178,057	6,000	22,173	12,499
1930 ..	1,420	94,332	525	170,997	1,000	35,348	37,424
1931 ..	795	67,766	..	156,950	..	8,038	250
1932 ..	180	47,776	300	178,466	..	..	..
1933 ..	30	42,022	..	214,445	160	..	..

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL COMMERCIAL FERTILIZERS FOR YEAR 1932–33, SHOWING COUNTRIES OF ORIGIN AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Chile.	Australia.	Pacific and Indian Oceans Islands.		Great Britain.			Canada.	Belgium.			France.	Germany.	Poland.	Norway.	Netherlands.	Egypt.
	Nitrate of Soda.	Bone-char.	Source.	Raw Phosphate.	Basic Slag.	Sulphate of Ammonia.	Phosphate.	Sulphate of Ammonia.	Basic Slag.	Raw Phosphate.	Potash Fertilizers.	Potash Fertilizers.	Potash Fertilizers.	Potash Fertilizers.	Cyanamide, &c.	Phosphate.	Phosphate.
Auckland ..	1,222	..	Nauru/Ocean ..	100,424	5,200	3,550	15	..	18,864	3,655	35	535	1,082	160	..	650	..
			Tuamotu ..	10,507													
			Seychelles ..	3,194													
			New Caledonia ..	2,007													
New Plymouth	280	..	Nauru ..	19,619	2,539	825	..	..	8,339	426	..	225	369	125	..	..	..
Wanganui ..	..	..	Nauru/Ocean ..	23,876	..	..	..	..	..	..	..	..	..	..	..	..	..
Gisborne ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	..	..
Napier ..	..	..	..	..	..	..	..	..	..	..	..	5	..	..	..	..	..
Wellington ..	..	..	..	..	695	650	306	10	3,758	100	..	150	376	120	..	..	160
Nelson ..	..	..	..	..	60	420	..	..	150	..	..	..	145	..	..	..	..
Lyttelton ..	120	..	Nauru/Ocean ..	17,771	..	330	..	50	..	..	..	..	60	..	..	..	..
			Tuamotu ..	2,253													
Timaru ..	..	..	..	..	..	65	..	10	..	..	..	25	30	..	..	..	..
Dunedin ..	240	..	Nauru/Ocean ..	26,698	..	670	102	10	175	350	..	20	217	..	..	..	..
			Tuamotu ..	1,258													
Invercargill ..	..	30	Seychelles ..	6,838	175	150	420	100	2,067	..	40	90	265	70	..	..	..
Totals ..	1,862	30	..	214,445	8,669	6,660	843	180	33,353	4,531	75	1,050	2,544	475	5	650	160

NOTE.—Additional items, not included in above table, are as follows: Unenumerated fertilizers, 51 tons (Great Britain, Belgium, United States of America, Malaya, Netherlands); bonedust, 625 lb.; and sulphate of iron, 7 tons (Australia).

COD-LIVER OIL FOR BROODER CHICKS.

A FURTHER EXPERIMENT AT WALLACEVILLE.

H. A. KITTO, Overseer, Wallaceville Poultry Station.

DURING the breeding season of 1931 an experiment was conducted at the Wallaceville Poultry Station for the purpose of ascertaining whether cod-liver oil, when included in the ration for brooder chicks, would have any influence in promoting good health and bodily development. The results of this experiment were published in the *Journal* for July, 1932. A second experiment was carried out over a period of 12 weeks from 30th September to 22nd December, 1932.

Two hundred chicks were included in this test. They were bred from the same parent stock, hatched in the same incubator, and reared under similar artificial conditions. Two fireless brooders of similar design and size were used, 100 chicks being placed in each. Each lot of chicks was carefully weighed collectively before being placed under the brooders, and at weekly periods during the process of the test. Both lots of chicks received similar food and attention, excepting that the birds of Lot 1 had cod-liver oil added to their ration at the rate of ½ oz. daily for the first three weeks, 1 oz. daily from the third to the eighth week, and 1½ oz. from then on to the end of the test.

From the outset, and during the whole period of the test, both lots of chicks ate well and gave every indication that their food was palatable, while generally they presented a healthy, vigorous appearance. This is indicated by the fact that only three birds died during the test—one of the oil-fed birds and two of the controls.

As in the previous test, at no time could it be said, as a result of close observation, that the oil-fed birds presented a better general appearance than did the control birds. Particulars of the weekly weighings of both lots are given in the accompanying table.

Table showing Weekly Weighings of Chicks in the Experiment.

Weighing Date.	Number of Chicks.	Collective Weight.	Average Weight per Chick.	Total Weight gained Weekly.	Average Weight of Chick gained Weekly.
		No. 1 Brooder.—Oil-fed Chicks.			
		lb. oz.	oz.	lb. oz.	
30/9/32	100	9 0¼	1·44	..	..
6/10/32	100	11 15¼	1·91	2 15¼	7·56 dr.
13/10/32	100	15 3½	2·43	3 4	8·32 dr.
20/10/32	100	21 2½	3·38	6 15	1·11 oz.
27/10/32	100	25 4¼	4·04	4 1¾	10·52 dr.
3/11/32	99	32 12½	5·29	7 8¼	1·21 oz.
10/11/32	99	45 11¾	7·39	12 15¼	2·09 oz.
17/11/32	99	61 9	9·995	25 13¼	4·17 oz.
24/11/32	99	83 12¼	13·53	22 3¼	3·588 oz.
1/12/32	99	104 11½	16·92	20 15¼	3·38 oz.
8/12/32	99	130 12¼	21·13	26 0¾	4·209 oz.
15/12/32	99	165 15½	26·82	35 3¼	5·69 oz.
22/12/32	99	193 4½	31·238	27 5	4·415 oz.

Table of Weighings—continued.

Weighing Date.	Number of Chicks.	Collective Weight.	Average Weight per Chick.	Total Weight gained Weekly.	Average Weight of Chick gained Weekly.
		No. 2 Brooder.—Control Chicks.			
		lb. oz.	oz.	lb. oz.	
30/9/32	100	9 2½	1·46	..	..
6/10/32	100	12 4½	1·96	3 2	8 dr.
13/10/32	100	15 11	2·51	3 6½	8·72 dr.
20/10/32	100	21 12½	3·48	6 1½	15·60 dr.
27/10/32	100	27 1¼	4·33	5 4¾	13·56 dr.
3/11/32	98	34 7	5·62	7 5¾	1·202 oz.
10/11/32	98	45 7½	7·42	11 0½	1·80 oz.
17/11/32	98	64 5½	10·5	18 14	3·08 oz.
24/11/32	98	80 12¾	13·19	16 7¼	2·68 oz.
1/12/32	98	103 15¾	16·97	23 3	3·78 oz.
8/12/32	98	128 11¾	20·018	24 12	4·04 oz.
15/12/32	98	164 10½	26·88	35 14¾	5·86 oz.
22/12/32	98	195 15¾	31·99	31 5¼	5·11 oz.

DAIRY FACTORIES IN NEW ZEALAND, 1932-33.

THE following table presents the registrations of factories under the Dairy Industry Act as at 31st March, 1933, together with the quantities of butter and cheese forwarded to grading-stores for export during the year ended 31st March, 1933, and the numbers of milk or cream suppliers to the factories during the same period :—

District.	Number of Factories.				Forwarded for Export, 1932-33.		Number of Suppliers to Factories.		
	Butter.	Cheese.	Dual Plant.	Total.	Butter.	Cheese.	Butter.	Cheese.	Dual Plant.
					Tons.	Tons.			
Auckland ..	62	38	4	104	82,438	18,867	24,593	1,197	413
Taranaki ..	19	71	31	121	10,642	40,675	3,429	1,835	2,210
Wellington ..	20	51	6	77	12,473	12,952	6,634	1,188	671
Hawke's Bay ..	9	17	1	27	6,576	4,248	4,673	402	387
Nelson ..	6	2	1	9	1,815	372	1,763	27	65
Marlborough ..	3	4	1	8	756	881	851	144	36
Westland ..	10	1	..	11	827	40	794	8	..
Canterbury ..	11	14	1	26	2,700	1,728	7,679	302	229
Otago and Southland	10	77	1	88	2,245	16,479	6,403	3,329	360
Totals—									
1932–33 ..	150	275	46	471	120,472	96,242	56,819	8,432	4,371
1931–32 ..	149	263	56	468	99,548	83,299	51,407	6,906	5,633

Whey butter was manufactured as a side-line at sixty-three of the above cheese-factories in 1932–33, the total quantity forwarded for export being 1,787 tons. This is not included in the total amount of 120,472 tons of butter given in the table, which refers to creamery butter only.

In the 1932–33 period there were also operating in the Dominion four milk-powder factories (two whole-milk and two skim-milk plants), six casein-factories, two condensed-milk factories, and one sugar-of-milk factory.

—*Dairy Division.*

SEASONAL NOTES.

THE FARM.

July Top-dressing.

In view of the serious decline in pre-winter top-dressing of pastures there is a possibility, which it is to be hoped will be realized, that the autumn decline will be largely counterbalanced by a spring expansion in top-dressing. It is known from extensive field experience that top-dressing, if not already done, often may be carried out with good results in July. Usually it is desirable to have pasture growth stimulated as early as possible in spring, and, when this is so, then ordinarily superphosphate should be used. In some of the main dairying districts, even on relatively wet cold soils, superphosphate applied in July may be expected to produce appreciable increases in the amount of feed available in August.

From this it is not to be concluded that July is the month which should be selected for the application of superphosphate ; repeatedly in these pages the application of superphosphate and of other phosphates to grassland much earlier in the season has been recommended. But many who have not top-dressed in the autumn would be wiser to do it in July or thereabouts than to omit top-dressing for the season.

If the season is not such as to lead to an unusually late growth of grass, then the application of sulphate of ammonia, or similar nitrogenous fertilizer, about mid-July to suitable pastures may be expected to result in a material increase in the feed available from the treated fields during August and September. For a few weeks prior to the middle of July it is usually inadvisable to apply such nitrogenous fertilizer ; it appears not to be capable of stimulating growth in plants, which are dormant primarily because of cold conditions, and when quick-acting nitrogenous fertilizer is applied under such conditions its potential fertilizing effect appears to be not so much deferred as wasted. As a general rule superphosphate should be used in conjunction with sulphate of ammonia. While soluble nitrogenous manures such as sulphate of ammonia may be expected to be of some service as emergency means of increasing the growth of grass in the early part of the ensuing season, especially when there is prospect of injuriously scant supplies of early feed, the current prices of farm produce make it advisable to consider carefully the amount of prospective service in relation to the value of that service. It is impossible to supply specific guidance on this matter, for much depends on how acutely additional early feed is needed and how it could alternatively be supplied.

Harrowing and Spelling of Pastures.

Harrowing of pastures is work which widely calls for attention in July. It is likely to be especially necessary to break up and to distribute droppings on fields which have been heavily stocked during May and June. Suitable harrowing of swards containing rubbishy matted growth is considered of substantial value as a means of cultivating such swards—by tearing out the rubbishy growth to some extent and opening up the surface. Hence on matted pastures a much more drastic treatment is likely to be justified than on well-grazed, healthy, vigorous swards on which thorough distribution of animal droppings is of outstanding benefit. To facilitate thorough distribution a section of chain harrow attached behind the grass harrow is generally found to be of value.

It is very advisable to avoid any early set-backs in early calving cows and of early lambing ewes, and so attractive suitable feed should be available for these. To provide such feed it is often well to shut up, in July,

suitable paddocks—ones which preferably are well drained, provided with shelter, and supporting swards in which rye-grass is prominent. An early dressing of such paddocks with superphosphate, if they have not had the benefit of pre-winter top-dressing, is likely to be of assistance.

Winter poaching of wet, soft paddocks requires to be guarded against as far as possible. Young pastures especially are prone to suffer. Heavy trampling of soft paddocks leads not only to the direct loss of valuable plants by burial, but also to the possibility of the establishment of such weeds as thistles, rushes, buttercups, and daisies on the bare portions which result from the burial of valuable constituents of the sward. This explains why a wet winter is at times followed by a seemingly unaccountably heavy invasion of such weeds on pastures in which they were not previously prominent. In practice two of the main ways of preventing avoidable poaching are, firstly, the stocking of low-lying paddocks as little as possible, and, secondly, the feeding-out of hay, &c., on the drier portions of the farm (that often are also the poorer portions), which benefit most markedly by the increased fertility which feeding-out brings.

Stocktaking of Pastures.

As certain important weaknesses of pastures stand out prominently during the winter, it follows that a critical scrutiny of pastures in winter is likely to be serviceable as a means of disclosing weaknesses which on account of relatively gradual development may go unnoticed until they have become so marked that it proves unnecessarily costly to remedy them. A healthy green winter colour of pastures suggests good supplies of nutriment, effective drainage, and management which has avoided matted or coarse growth. Conversely, lack of a healthy green colour may be indicative of the advisability of top-dressing, of poor drainage, or of poor utilization.

In addition to noting the colour, an effort should be made to compare the present composition of the pasture with that of a season or so previously. In view of reductions in top-dressing which are occurring, evidences of deterioration are specially worth watching for. Increased prominence and spread of perennial rye-grass may be taken as evidence of all-the-year-round improvement. Cocksfoot plants possessing freshness, leafiness, and vitality suggest at least well-being, if not improvement. On the other hand, a gradual decrease in perennial rye-grass or a somewhat moribund condition of cocksfoot, especially if coincident, as is probable, with a rise in prominence of brown-top and flat weeds, such as plants of the rib-grass and dandelion type, may be taken as unwelcome evidence of a need to examine whether methods which would avoid deterioration could not profitably be adopted.

A relatively sudden falling-off in the proportion of perennial rye-grass in a pasture, while possibly due to decreased fertility or unsuitable treatment, is not at all necessarily so. It may be due to the ravages of the grass grub. Especially in a pasture of one to two years of age it is more likely to be due to the use of an inferior type of rye-grass, which, though spoken of as perennial, really lacks persistency. Great prominence of white clover and the rapid replacement in young pastures of rye-grass by such weeds as sorrel, and even rushes, are also at times due to the same cause. The only thoroughly reliable way of avoiding unnecessary untimely disappearance of rye-grass is the use of the true perennial strain available through seed certification.

Winter is an excellent season in which to study whether the inferiority of a pasture is due to poor drainage, which drives out the better species of pasture plants. If drainage is good and yet any rye-grass present is not thriving, then top-dressing may be expected to give good results.

In many cases a question of moment which arises at this season is whether ploughing down of the worn-out sward would not initiate the most satisfactory and profitable journey to an improved permanent pasture.

At times the tendency has been to repair a worn-out sward when the better course would have been to renew it. Repairing is a relatively slow process and the amount of improvement which can be effected through it is determined by the plants which are present at the outset, and so at times the possible improvement is undesirably limited. On the other hand, a process of pasture renewal by means of breaking up the worn-out sward not only can be accomplished quickly, but also gives an opportunity of introducing more suitable species and of employing better strains that may not have been available when the pasture was previously established.

A Critical Feeding Period.

In stock-feeding the month of July is usually a critical one, and especially is so in respect to immature stock and to pregnant dairy cows and ewes. Developing-animals, such as dairy heifers and hoggets, are susceptible to serious and possibly permanent set-backs as a result of hardship arising primarily from malnutrition in the winter. In the dairy heifer the permanent set-back may take the form of a stunting in size, which experience suggests is linked with a corresponding stunting in yield. Hence it usually proves profitable, eventually, to give both heifers and hoggets the best feed available. This is not consistent with the feeding of straw, poor hay, or stemmy grass-growth to such animals. Feed relatively rich in digestible supplies of body-building material is required, and can be provided by a suitable selection from such substances as leafy grass, good hay, roots, and green crops.

During the period when she is not yielding milk the dairy cow should be fed liberally enough to enable her to undergo what in Britain has been called a "steaming-up" process, in which she forms bodily reserves of strength and substance which are drawn upon during the subsequent producing season, and which assist her in warding off disorders that are of common occurrence at about calving time.

Recent New Zealand work has served to demonstrate the importance of good winter feeding of ewes kept primarily for fat-lamb production. As might be expected, it has been shown that the economical production of fat lambs is determined to a considerable extent by obtaining lambs of good weight at birth, and this in turn is determined by good winter feeding of the ewes.

The acute need of good winter feeding of heifers, hoggets, dairy cows, and breeding ewes is of current importance not only because of its application to the present winter, but also because the planning of feed-supplies for the following winter should now be receiving attention. As to the present season, the recommendations in last month's notes relative to crop utilisation are generally applicable during July.

After the swede crop has been utilised carrots, if available, should be fed: mangels, having the best keeping qualities, being reserved for the final feeding of roots for the season. Chou moellier, which is generally in good condition for feeding in July, should then be consumed, for at times in August it is inclined to "bolt" to flower-heads. In the case of autumn-sown cereals which are to be fed off it is well to bear in mind that in general two light feedings of short growth are more satisfactory and involve less waste than one feeding of heavy growth.

Tillage for Arable Crops.

Generally, sowing of seed in July should be avoided as far as possible. Hence, if land which is intended for wheat cannot be sown by about mid-June, the sowing usually may well be deferred until August, unless there is some special circumstance, such as a considerable prospect of a subsequent rush of work, which it would be difficult to handle satisfactorily.

In preparation for the spring sowing of cereals, mainly in the August–October period, all possible progress should be made with the necessary

tillage, but it should not be overlooked that on much land, and on the heavier types of soil in particular, so much water may be present as to make tillage injurious. When the soil clings freely to implements or boots, then cultivation, even though urgent, should be deferred. Ploughing of old grassland at times can be carried out safely when working of adjacent land which has recently been under cultivation would be injurious because of its wet condition. But ploughing even of such grassland should be postponed when the soil is so wet that a glazed-looking surface is produced on the furrows.

Preparation for Lucerne.

Judging from the amount of "culture" sent out from the Plant Research Station last season, several thousand acres were sown down in lucerne during the year. This is gratifying, for success with lucerne in New Zealand has been prolonged and extensive enough to demonstrate definitely that the present total area of lucerne could profitably be greatly extended. Expansion will probably not take place as rapidly as is well justified until the truth that lucerne is not especially exacting is more popularly accepted. Actual field experience indicates that lucerne can be grown successfully on practically all types of naturally well-drained soils. Deep, open, fertile soils are undoubtedly best for lucerne, and the crop has enough intrinsic worth to justify its being given the best possible location on each farm.

If preparatory cultivation for new areas of lucerne has not already been started, it should, as a rule, be commenced at an early date. In the selection of an area it should be remembered that young lucerne is not capable of battling well against weeds. Lucerne may often well follow old pastures, and if this is to be done the land should usually be skim ploughed well ahead of the time of seeding, and subsequently ploughed deeply once only in ample time to allow of the preparation of a fine firm seed-bed. Further information about lucerne is given in this Department's Bulletin 155, which is available for free distribution on application.

R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Pruning Operations.

It is recommended that pruning, particularly in large orchards, should be pushed on with as little delay as possible. Pruning is a scientific operation and should on no account be undertaken by an unqualified person. No sane builder starts to erect a building without first fixing upon a design to follow; neither does he commence to build until he has laid a solid foundation. The successful orchardist, like the builder, should also have a design to follow, and a strong foundation—the rooting-system—upon which to build his tree.

The builder has the design of his building drawn up in black and white. The orchardist, however, must carry the design of the tree in his mind's eye. The main object sought by the adoption of a distinct design for the tree in commercial orchard practice is to secure one which will produce the maximum quantity of highest-grade fruit at a minimum cost. With this object in view a comparatively short-stemmed tree open in the centre, with strong sturdy leaders and subleaders spaced evenly all round at intervals of at least 2 ft. apart, is recommended. No hard-and-fast rule can be laid down as to how many leaders the tree will ultimately carry; that depends upon the spread and growth of the tree. An open centre will not only ensure an even distribution of sunlight and air to every part of the tree—so vitally necessary for the development and

ripening of buds, wood, and fruit—but it facilitates spraying and picking operations. The leaders and subleaders, which are in reality the frame of the tree, should originate from the trunk at the desired height so as to form an oblique angle. They must be strong enough to carry a heavy load of fruit, and sufficiently wide apart to permit the lateral growths or fruiting-arms to develop between them.

A tree of this design recommended for apple, pear, quince, apricot, peach, nectarine, plum, and cherry offers the following advantages: (1) The fruit may be quickly and safely harvested; (2) the pruning and treatment for diseases is easily, rapidly, and effectively performed; (3) the ground is shaded in midsummer above the root system; (4) the soil may be cultivated without obstruction as close to the stem as is in keeping with safety; (5) it possesses the strength necessary to withstand boisterous winds.

In these notes only a few of the chief facts on which the theory of pruning is based can be given. If the frame of the tree is correctly designed, however, and the rooting-system sound, there should be no great difficulty experienced in pruning, provided the pruner is sufficiently conversant with the habits of the different varieties of fruit-trees to anticipate the result of each cut made. The main object of pruning is to develop and maintain a supply of short sturdy laterals and spurs on which to carry the fruit, to increase the appearance and quality of the fruit, to secure regular crops over a long period, and to accomplish all of these upon the most economic lines.

It must be kept in mind that each tree has its own individuality and should be pruned accordingly. A tree making vigorous wood growth should be pruned as lightly as possible, with a view to retarding the flow of sap, and thereby developing fruit-spurs. On the other hand, a weakly growing tree should be pruned more severely with a view to accelerating the flow of sap and throwing the tree into new growth. Such growth should be evenly distributed throughout the whole tree. This can only be accomplished by a fairly severe and systematic thinning-out of fruit-buds, laterals, &c., plus the aid of manure and a general improvement of soil conditions.

The pruner should also bear in mind the following facts: The vigour of a shoot is dependent on the leaf surface borne upon it; the nearer a shoot approaches a vertical position the stronger will be its growth; the nearer a shoot approaches a horizontal position so its vigour diminishes; and if the root system be reduced the vigour of the top growth will be correspondingly diminished.

Grafting and Budding.

The scions for grafting should be selected at pruning time from well-developed wood of the past season's growth and kept in a shady place until required. If the trees to be grafted are cut down at this time, it will be necessary, just prior to inserting the scion, to make a fresh cut.

Stone fruits to be budded should now be cut back to the desired height, so as to induce suitable growth for budding into.

Wounds and Wound Treatment.

It is well to remember that a fruit-tree is a living organism; it breathes and takes nourishment; its sap circulation is as important to the tree as blood circulation is to the human body. Therefore it behoves the grower to make sure his trees are supplied with air and suitable nourishment, and that the sap circulation is free and healthy. When a limb is removed the tree is more or less wounded, and steps should be taken to treat the wound so that it will heal or callus over as quickly as possible. Dr. G. H. Cunningham deals with this subject very fully in his book, "Fungous Diseases of Fruit-trees," pages 31–36.

—J. W. Whelan, Orchard Instructor, Palmerston North.

Citrus Culture.

The first most important work among established citrus-trees at this period is to constantly guard against excess water at the roots. Under-drainage is one of the first essentials, but even where this is thought to be adequate excess water is apt to accumulate during the rainy season. A furrow opened up from low-lying areas, or a temporary drain made with a spade, are a means of removing excess, particularly surface water. Excess, particularly stagnant water, even though of temporary duration, is especially repugnant to citrus plants.

Some pruning will be required among lemons, where growths from 3 ft. to 4 ft. in length of an extended unfurnished nature are often found. These growths were made during the past autumn and will naturally divide at the tips towards springtime if left uncut, giving the tree that form of straggly growth difficult to deal with later without the loss of crop. These long shoots should be pruned now to about half length. They will then give rise to side growths of good fruiting habit where required by the grower. It is possible that if all such long shoots are so treated the tree will become too bushy and compact. In this event only the required number for which good space can be found should be allowed to remain.

Harvesting of lemons which attain correct size should be done, and fruits put away for curing and storage. It is very marked that at this season lemons which are left on the trees to attain ripe condition are most susceptible to citrus brown-rot, and after harvesting readily become infected with it. Precautions should be taken to guard against brown-rot, and during fine weather a bordeaux spray, 4–4–40, should be applied. Where brown-rot shows up every care should be taken to collect and destroy diseased fruits, rather than allow them to become the source of further infection.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Selection of Eggs for Hatching.

Now that the hatching season is at hand it is well to reiterate that the size of all eggs put down for the renewal of stock should be given careful consideration by the poultry-keeper. The question of the small egg is becoming a serious one from an industrial standpoint, and unfortunately too many producers are aiming for numbers of eggs, thereby failing to counteract the tendency to produce small eggs. It is now generally realized that, if the producer is to make the most profit from his business, the export trade must be relied upon as a means of relieving the local market during the flush season. There is, however, ample evidence that our eggs will have to face keener competition on the overseas market than ever before, and that on the grounds of profit no eggs should be exported weighing less than 2 oz.

The egg-laying competitions have rendered the industry excellent service in developing the laying power of certain breeds of poultry, but those who control them have long since realized that the number of eggs produced should not be the only object, and that the weight of eggs laid by the competing birds is of equal if not of greater importance than numbers from a trade point of view. It is interesting to know the weight of eggs produced by the competing birds. These figures disclose valuable data, clearly indicating specialist stock that fail to lay eggs up to the standard weight. The executives are to be congratulated for not allowing prizes to be won by birds laying a second-grade product, and this must naturally assist to a great extent in raising the egg standard throughout the Dominion.

It must be admitted that in the past, under the crude system of marketing which has existed, the producer had little, if any, encouragement to breed for large eggs, as these did not command any better price on the local market than those of medium size. It is, however, pleasing to know that at last some of the distributing agents and retailers are setting themselves out to correct this weakness, inasmuch as the value of fresh eggs is now determined on weight. For example, there is now often a difference in price of 2d. to 3d. a dozen between eggs weighing 2 oz. or more and those under this weight and which are generally termed B grade. If this reform is to be made general throughout the Dominion, as it should be, then it will pay the small-egg producer to calculate his annual monetary loss through breeding from birds which lay lower-grade eggs. Even if a moderate-sized flock is kept the loss will probably astonish him.

The long-looked-for reform in having eggs sold (in at least some quarters) on their weight value tends to bring our system into line with that under which eggs are disposed of on the London market. These are paid for not only according to their weight, but according to their internal quality as well, and the sooner this system is adopted on the local market the greater will be the movement towards increased demand by the consumer and placing the local egg-trade on a sound footing. Egg pulp is sold by weight, and no sound argument can be advanced to prove that eggs in shell should not be disposed of in a similar manner. While it is true that it is the internal quality that appeals most to the consuming public, nevertheless it is not the egg weighing less than 2 oz. which will appeal most in catering for the high-class trade, whether it be on the local or overseas market.

There is no better method of raising the standard weight of eggs than by eliminating from the breeding-pens diminutive specimens of a breed, which, by the way, are unfortunately being too often bred from throughout the Dominion. In mating up the breeders it is especially important to know that the cockerel has come from a hen laying a good-sized egg, for, however satisfactory the size of the eggs of the female, the progeny will probably fail to maintain a good egg standard if the sire is the descendant of stock the eggs of which were of undesirable size. The warning is here and the remedy simple. Just as heavy-laying quality may be maintained and advanced by judicious mating, so the size of eggs may be maintained or advanced (in reason, of course) by the same process. A hen, however good a layer, should not be put into the breeding-pen if she lays a small egg.

Breeding Points.

While it is important that the hens in the breeding-pens be maintained in the best possible condition, it is of equal or even greater importance that the male bird should be well treated, so that he may be kept in a good breeding condition. Usually male birds, especially those of second or third season, are subject to infestation by lice and do not avail themselves of dust baths as is the case with hens. For this reason they should be periodically examined, and if insect pests are present they should be dusted with insect powder, or, better still, treated with nicotine sulphate. A simple and effective way of doing this is to dip a feather into the liquid and draw it under both wings, or by putting a small amount between the breast feathers. Do this at dusk, just when the birds are going to roost.

Male birds which carry large combs and wattles which are common in such breeds as Leghorns, Minorcas, &c., should have these removed before being placed in the breeding-pen. As a result of this operation a bird will invariably fertilize more eggs, with stronger germs. The operation can be simply performed by means of a pair of sharp scissors, a good

dressing of iodoform being applied to the cut parts to prevent bleeding and other after-effects. Long spurs on the male bird are another common cause of infertility of the eggs, and often result in hens having their sides badly ripped. The points of the spurs should be removed with a fine saw within, say, ¾ in. of the shank, and if a little Stockholm tar is dabbed on the surface of the cut parts little or no bleeding will result.

Mating.

The number of hens to mate with one male depends entirely on the local or surrounding conditions affecting the stock and plant. Where a free range is provided a high proportion of fertile eggs may be obtained by using one male to twenty or more females, but when the birds are confined in a house or run the number of females must be considerably reduced if good results are to be obtained. No hard-and-fast rule can be laid down in this respect. The poultry-keeper must use his own discretion and be guided by the number of fertile eggs produced. In a general way, when the birds are confined and during the early season six to eight of the heavier type will usually prove sufficient for one male. If the male is vigorous this number may be increased as the season advances. With the lighter breeds, such as Leghorns or Minorcas, eight females may be mated to one male, and in the spring months up to twelve or even fifteen. Reference is here made to the case where a cockerel heads the breeding-pen; generally, adult males cannot be depended upon to produce a desired number of fertile eggs, particularly during the early season, even when mated to a smaller number of hens.

Green Food.

It may be well to again emphasize the importance of having everything in readiness for the growing of an abundant supply of succulent green material for future use. Ample green stuff not only makes for economical production, but is an essential requirement for the maintenance of good health in birds of all ages. Young stock in particular will never make sound development if deprived of green food during the growing stage. Silver-beet is an excellent thing to grow for poultry, and is a heavy cropper, besides which it is not subject to attack by insect pests as is the case with any of the cabbage family, rape, &c. The value of silver-beet and its resistance to pests, as compared with many other plants, was well demonstrated during the past season.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Moving of Bees.

At this season of the year bees may be moved to a new location with perfect safety. If the work is left until spring, when the activities of the hive commence, the resultant loss of field-bees will be enormous. More especially should advantage be taken of the bees' dormant condition if the hives are to be moved short distances only. The colonies are numerically weaker, and there is usually little brood to become injured in transport. When hives are located for any length of time in one position the flying bees take full observation of every landmark, but as in the winter there are shorter periods of sunshine the flight of the bees is necessarily curtailed, and they usually return at a much shorter distance from the hive. In addition, there are often periods of several days together during which

they take no flight at all, and in consequence they must renew their acquaintance with their surroundings when an opportunity for flight occurs. Therefore, if the hives are moved during a spell of bad weather, the bees will take more readily to their new location when a fine day comes. Any bee-shifting operations should be completed before the end of July.

To secure bees for transit over a short distance sufficient ventilation can be provided by tacking a piece of wire gauze over the hive entrance. It is then only necessary to secure the bottom and roof, and, after making sure that there are no holes through which the bees can escape, the hive may be carried with safety.

The successful moving of bees over long distances calls for considerable preparation. All heavy combs should be secured, and only sufficient honey left in the hives to prevent the bees from starving during their journey. The most important factor is ventilation, and neglect of this matter leads, as a rule, to heavy losses when bees are being moved. The constant vibration of any vehicle tends to disturb the cluster, and the excitement caused thereby is sufficient to raise the temperature of the hive considerably, so that the bees are in danger of being suffocated and the brood scalded. These troubles can be avoided by the employment of wire screens. First see that the frames are made as secure as possible by inserting two wedges between the side of the hive and the top of the end frames. This prevents the frames from rocking during transit. The bottom-board should then be secured to the hive-body by means of crate-staples, driving one end of the staple into the hive-body and the other into the bottom-board. Usually six staples are sufficient. The screens can be made by using narrow laths nailed together to form a frame of the same dimensions as the hive-body and covering this with wire cloth such as is used for making queen-cages. The screens must be securely fastened to the top of the hive and the entrance covered with wire cloth. By this means ample ventilation is provided to ensure the safe carriage of the bees during the winter months.

In these days of motor transport the work of moving bees over long distances is greatly minimized, and the beekeeper will be well advised to adopt this method if it can be obtained. In any case, the beekeeper who has occasion to move bees should not relax any effort to make the hives secure when moving to a new location.

Condition of Hive Mats.

At intervals during the winter months the mats should be examined to note their condition. After heavy rain the mats are liable to become damp, and should be removed and dry ones substituted. To save delay a supply of dry mats should always be kept on hand. As far as possible do not disturb the colonies when making an examination, and especially avoid jarring the hives. The roof can be carefully lifted and the mat examined. If the latter has to be removed, see that the smoker is handy in case the bees are troublesome, but do not use smoke unless the bees have to be driven down. Remove the wet mat as speedily as possible, replace it with a dry one, and cover the hive.

Leaky Covers.

Damp mats usually point to defects in the covers, and it should be worth the beekeeper's while to remove these also. At all seasons the comfort of the bees should be one of the main considerations, and this factor cannot be ignored if successful wintering is to be expected. The labour involved in keeping the hives watertight will repay their owner many times over, and prevent to a large extent the loss of heat generated by the bees. One should aim at reducing the waste of energy of the bees by maintaining the heat of the cluster at an even temperature during the

unproductive season, and this will be impossible where leaky roofs are tolerated. Successful wintering is a high test of the beekeeper's capabilities.

Permanent Shelter.

Now that the actual work of the apiary is off the beekeeper's hands for a while he may devote his attention to the matter of providing permanent shelter for the hives. If he has definitely decided on a permanent location for the apiary he should now set about the cultivation of a quick-growing hedge. This matter is a most important one, and ranks next to that of locality. It is noticeable in sheltered situations that the bees are able to take cleansing flights during the mild days of winter, whereas bees in unsheltered positions are often confined to their hives even on sunny days. An occasional flight in the winter is as necessary for the welfare of the bees as any provision the beekeeper can make for their comfort. In addition to protecting the bees during the winter from stormy winds, shelter is an incentive to increased brood-rearing in the spring and early summer.

Whatever shrubs or trees are provided for the purpose of producing a permanent hedge, they should be planted thickly, and trimmed to produce abundant foliage, especially at the base. It is highly important that the plants shall stand cutting-back, so that the hedge can be kept at a reasonable height. Hedges grown to a height of 8 ft. to 10 ft., and no higher, will provide ample shelter for a large apiary. There will also be less trouble in taking swarms if the trees are kept to the height indicated. Locality and situation must to a large extent influence the beekeeper in choosing the most suitable plants, but, whatever the hedge, the idea should be to form thick shelter and not a plantation.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Fertilizers and Manures.

CONTINUOUS cropping and intensive cultivation can only be carried on successfully with a very sound knowledge and careful practice of the use of these aids. Local customs in this respect should receive careful consideration, as they are usually built upon practical experience over a fairly long period under the local conditions of soil and climate, which are major factors in the problem. The crops, however, are so varied, and settlement in this country is so recent, that treatment of this kind is not yet established on traditional lines as in older countries, where intensive cultivation and experiment have been carried on over a very long period. Much can be learned from these ancient traditions elsewhere, but it must be very carefully adapted to our new conditions.

Where new land of good quality is carefully broken in and a short rotation is adopted before laying it down again in pasture, there is little difficulty under this heading, if live-stock is grazed and farm manure is available. A moderate quantity of phosphate in some form, and perhaps potash if the land is light, may possibly be all that is required. Such conditions are ideal for maintaining fertility and controlling diseases.

The problem, however, is more difficult when comparatively permanent crops of vegetables and small fruits are grown, and especially where continuous cropping with a very limited number of crops has to be done, as in the case of market gardening or the homestead garden. The successful cultivator of this class is a really good judge of soil condition and plant nutrition as far as his crops are concerned. From the results with the previous crop and the condition of the one under cultivation of the same

kind he is almost unerring in his prescription of fertilizer treatment—in kinds, quantities, and periods of application. It will generally vary with the kind of season that is being experienced and any other vicissitudes that affect the crops in question. Successful crop production is very largely due to this knowledge and its careful application, which produces not only large quantities but high quality, and builds up a reputation for the producer which is generally remunerative.

Manures are sometimes classified under the headings of organic and inorganic. Under the first come all animal and vegetable matter of any kinds, and under the other chiefly mineral substances that are often spoken of as chemical or artificial fertilizers. The practice of just referring to the first class as manures and the second class as fertilizers, as has been done in the heading of this section, is now common. Finely-ground fertilizers are available in any quantity, and there is a natural tendency to depend on them entirely. This is one of the serious mistakes made at the present day in this class of cropping. Both manures and fertilizers are necessary in intensive cultivation, and the conservation of the former could well receive further attention.

The " farmyard " manure referred to in overseas literature has reference to the large enclosure deeply bedded down with straw to which many farm animals are confined during the cold winter months ; by this means very large stocks of this manure are accumulated. In our comparatively mild climate, where farm animals are turned out to graze throughout the year, such quantities are not available ; but what there is should be conserved by being stacked in a compact heap where it will not be interfered with by fowls, &c. Nature will then, in her usual beneficent manner, soon reduce the waste material to a fertile mould of great value by means of fermentation ; but for this to take place the material must be stacked in a compact heap and be in moist condition. In a few instances the material is prepared for use by drying it out—desiccation—and grinding as in the case of fowl manure ; but otherwise it is better stacked as described until it is in a sufficiently matured state for distribution.

In the absence of such resources, or to supplement them, vegetable matter of any kind, so long as it does not contain a serious plant disease, makes valuable manure. It may be ploughed or dug in in the green state, or, if that is not convenient, it, too, can be stacked to ferment ; but the conditions previously mentioned must be observed—the material must be moist and stacked in a compact manner. During winter and early spring it is usually convenient to turn it in immediately ; but the flush of growth in odd corners about the place during spring and summer could often be cut once or twice and processed with the added advantage of preventing weeds seeding and giving the place a better appearance. Lawn mowings and other odds and ends of organic matter may be added. Where the quantity is large a trench 5 ft. or so wide, 1 ft. deep, and any suitable length may be opened up, placing the soil along each side. The green stuff as obtained should be stacked in the trench to a height of about 5 ft., when the excavated soil should be placed on top to compress and seal the stack. This sealing can generally be done conveniently about the end of the year, and the material is then in excellent condition for use during the early winter. So that pressure is even throughout, the material must be carefully spread and consolidated while the stack is being built.

In the home garden, where resources of this kind are limited, a bin of convenient size may be built, or dug out of the side of a bank. At least once a week the material should be spread evenly and trodden firmly. About the end of December it should be sealed by covering with about a foot of soil.

When applied to the garden such manures supply the humus which has such beneficial influence on the mechanical condition of the soil, as well as

supplying nitrogen and mineral plant-foods. These, however, are not in soluble form for the immediate use of the plants as are many fertilizers, which may also be used to supplement any deficiencies.

The availability of plant-foods is a feature demanding careful consideration. Even the most soluble is sometimes applied with little result when the soil is dry and no rain falls. The delayed action may then take place during autumn months, and possibly cause injury by encouraging growth when the crop should be ripening. So it is to be remembered that humid conditions are obviously necessary to speed up the action of manures and fertilizers. Also the process of disintegration, which is necessary for most of them to become available, is more rapid in a light soil as compared with a heavy one. To such an extent is this so that on light land in a moist climate many fertilizers classified as " slow " in action are preferable. This reaction of light land under such circumstances necessitates frequent applications of heavy dressings of manure, and explains why soluble fertilizers, as a general rule, should be applied to such soils " little and often " if they are to be used economically. A heavy soil is retentive in this as in other respects ; though " difficult " it is often " rich," especially in natural potash resources.

Many of the reactions of fertilizers in the soil and on the plants are important ; some are alkaline, and others are acid or salty to some extent. This is generally indicated in their name : nitrate of soda is an alkaline substance, the sulphates are inclined to be acid, and some of the forms of potash contain salt. Such qualities may be an advantage or a disadvantage. It depends on the class of land and the requirements of the crop. Nitrogenous manures, when made available to the roots of plants, usually have the effect of greatly increasing growth. Nitrate of soda is water-soluble, and in a form suitable for the immediate use of the plant ; for cabbages, lettuce, asparagus, and other crops, where vigorous growth is desired, it is specially useful in the springtime, when temperatures are too low for the natural production of nitrates by bacterial processes to take place to any extent. It leaches out readily in a light soil, so that small applications at intervals are most economical. On heavy land it has the effect of releasing potash, but its continuous use makes heavy land sticky and wet, so that a good tilth is unobtainable. This is caused by the soda deflocculating the clay—that is, the particles are resolved into their finest state of division and the mechanical condition is bad. This may be avoided or remedied by the occasional use of an acid fertilizer such as sulphate of ammonia or superphosphate.

On light lands, generally poor in potash, that ingredient should be supplied along with the nitrate of soda, or the growth will be soft and of poor quality. For here it is to be noted that the effect of potash is to increase the formation of starch and sugars and strengthen the tissues ; these effects are not quite so obvious as the growth produced by nitrates, but they are just as valuable. Phosphate promotes root formation in young plants, and specially does it hasten maturity and the production of fruit and flowers. By the use of such fertilizers any effect desired may, to a great extent, be obtained.

For the nitrification of sulphate of ammonia (a process necessary before it becomes available to the plant) lime must be present in the soil ; it may be applied in either a burnt or a raw state, but it is important that it should be in a fine state of subdivision. This is readily obtainable by slaking burnt lime, but as the raw lime (carbonate of lime) has to be ground in a mill fine grinding should be looked for when purchasing, as the total effect, practically, may depend on that alone. As an example, ground limestone passing entirely through a sieve 60 meshes to the linear inch in an experiment gave first-rate results, while that which was too

coarse to pass through a 20-mesh sieve gave crop results that were practically no better than those on unlimed control plots. Lime also assists plants in the assimilation of phosphoric acid and potash, besides its well-known influence on soil organisms and physical condition. On the other hand, crops have their preferences, and while potatoes, tomatoes, strawberries, oats, &c., do not care for lime much, cabbage, cauliflower, and others of that plant order are greatly improved by its presence. From such experience naturally arises the practice of satisfying the lime requirement of the soil just before planting a crop which is responsive to lime.

As the successful production of crops, especially of herbaceous and shrubby plants, depends chiefly on soil fertility, careful consideration should be given to these and other facts of the kind, together with any local experiences that may be obtained, as the natural soil conditions and climate are important factors in the problem.

Vegetable Crops.

With the lengthening days in the month of July, growth commences in hardy plants in the warmer parts of the country, and rather later elsewhere. It is important to take advantage of this opportunity so soon as it arises, as it avoids congestion of work in the middle of the busy spring period; it allows a long season of growth for such crops as require it, and, perhaps more important still, early crops may be harvested when they are most valuable or the weather is most suitable for ripening them off.

Crops of spring cabbage, cauliflower, and spinach making growth may be assisted with a moderate dressing of nitrate of soda, and, if the land is light, some sulphate of potash may be included. Take advantage of fine weather to hoe land down to a fine tilth, destroy seedling weeds, and work in such fertilizers as may be necessary in preparation for planting and sowing.

Good new land that has been well prepared will require little in the way of fertilizers for the first season; in other instances an ounce or two of superphosphate to the square yard, and a little sulphate of potash where the land is light, may be tried for most crops in the absence of any previous experience of the locality. If humus has been provided by turning in a good crop of green stuff or other organic material, and time has been allowed for it to decay, such a dressing of fertilizers should ensure a good average crop. Exceptions to this are the plots reserved for cabbage and other brassicas, and for root crops. The former should, in addition, receive a liberal dressing of lime so soon as possible; the latter the fertilizers only, as recent manuring (with organic material) causes misshapen roots.

So soon as the preparation is complete, and when the soil is in condition, plant out cabbage, cauliflower, artichokes, shallots, garlic, autumn-sown onion plants, and rhubarb; and sow broad beans, peas, spinach, lettuce, and other salads. In very few districts may early potatoes be planted now with advantage, but the seed should be examined and carefully prepared for sowing later.

Small Fruits.

Where a good dressing of phosphates was given in the autumn and a green crop sown between the rows, it should now be turned in lightly to avoid disturbing the roots. In its absence a dressing of bonedust, superphosphate, and potash would in many cases be suitable, but the supply of humus must be maintained, and a good dressing of old manure may sometimes be substituted. A similar application of fertilizers is usually applied now to beds of strawberries, but the salty types of potash should now be avoided, especially on heavy ground. On such land also it is

important, now and always, to avoid cultivation while the land is sticky with moisture; the damage done to the physical condition of the soil is serious and comparatively irreparable. Just as important is it to avoid disturbing the fibrous roots of these plants, which are so close to the surface; in some instances it may be best to merely work in the applications of fertilizers with the hoe or cultivator.

Tomato Crops.

Where crops are to be grown under glass the house is usually thoroughly cleaned of pests and disease spores so soon as the last crop is lifted, and the land sown down in a green cover-crop. This should now be turned under to decay and necessary fertilizers applied in preparation for planting out towards the end of August, or rather earlier in some districts.

Although heavy dressings of farm or stable manure causing vigorous growth should be avoided, the opposite extreme of allowing the supply of humus in the soil to become used up is also detrimental; this is very likely to happen where soil sterilization by means of steam is done frequently. An excess of nitrogen in the early stages of growth is what causes damage to the tomato crop. Although this plant does not specially require lime, it is the custom to apply it frequently with the annual dressing of fertilizers before planting, and where superphosphate is used extensively lime is doubtless necessary; but the phosphoric acid would probably be best applied to a very great extent in many instances in the form of finely ground bonedust, and in many instances, especially where continuous cropping has been done, the sulphate of potash dressing could with advantage be doubled.

This preparation should not be postponed, as all digging and trenching must be done in time to allow vegetation to decay and the land to consolidate before planting.

The Homestead Garden.

In preparing beds or borders for herbaceous plants the procedure usually is to work in a generous application of farm manure into the subsoil and a dressing of bonedust into the topsoil, or, for special occasions, if the topsoil is of indifferent quality to replace it with rotted turf. When the young plants are established they may sometimes be given liquid manure consisting of 2 oz. or 3 oz. nitrate of soda or sulphate of ammonia to 4 gallons water, once or twice, with advantage. With such a preparation the border should give satisfactory results for three or four years, when replanting will be necessary.

The shrubbery border is not usually treated so liberally, but trenching or double-ploughing should be done and abundance of humus should be incorporated in the soil. The area devoted to this class of plants is relatively large, and the position is generally met by selecting plants suited to the natural conditions. In many gardens extreme tidiness is aimed at in this department, leaves are gathered and removed, and the ground is dug over during the winter. Where the land is rich and moist this is often satisfactory, but otherwise the mulch formed by the leaves is very beneficial, and great improvement in the condition of the plants will often be obtained by supplementing the mulch with a good dressing of well-decayed farm manure now. If the greatest neatness is insisted on, the mulch may be turned under, but the digging must be very shallow, as the roots of most of these plants are close to the surface and their injury will seriously check the growth above. The plant-food, moisture, and warmth supplied by the mulch is most beneficial, and is an important feature in the natural conditions where these shrubs thrive best.

—W. C. Hyde, Horticulturist, Wellington.

WEATHER RECORDS: MAY, 1933.

Dominion Meteorological Office.

Rainfall.—The average rainfall for May was much exceeded over almost the whole of the North Island. Taranaki had at least half as much again as the average, while Hawke's Bay and Poverty Bay had almost double. A few places in the eastern portion of the Bay of Plenty and the extreme north of the Auckland Peninsula recorded less than the average. In the South Island conditions were more variable; totals in excess of the normal predominated considerably, but about Tasman and Golden Bays, in the interior of Marlborough, in South Canterbury, and North Otago, many places reported a shortage. In most of Southern Otago and Southland the excesses were large.

Temperature.—In Auckland Province west of the main range and in the interior of Otago temperatures were somewhat above normal, but elsewhere they were below. Most of the first half of the month was cold owing to the persistent south-westerly winds. In the latter half, also, owing to the absence of sunshine, the mean temperature was on the cool side. There were no extremes, however. The mountains received heavy coatings of snow in the early part of the month, but much of it had disappeared by the end. Comparatively few frosts occurred.

Sunshine.—Owing to the very dull conditions prevailing from the 20th onwards there were very few places which recorded the average amount of sunshine for May. New Plymouth with a May average of 159·8 hours, for example, recorded only 99·8, while Timaru with an average of 148·9 hours recorded only 93·1. Blenheim with 157·1 hours had the highest total.

Pressure Systems.—As regards the type of weather experienced, the month may be divided into three distinct periods. During the first, conditions were similar to those which prevailed during the greater part of April, pressure being continuously high over Australia. From the 3rd to the 6th the weather was unsettled while a complex westerly depression moved across the Tasman Sea and southern New Zealand. The main portion passed on the 5th, and from then on south-westerly winds predominated in most districts. By the 7th barometers had become very high in eastern Australia and the south-westerlies thoroughly established in New Zealand. They continued without intermission until the 12th. Throughout this period cold, squally, and showery weather was experienced, especially in districts with a westerly aspect. The 8th was a particularly unpleasant day. South-westerly or southerly gales and hailstorms occurred at many places, while snow fell on the high levels of the South Island. On the 6th and 7th, also, there were heavy snowfalls on the ranges. Eastern districts did not fare so badly during this first part of the month, being protected by the ranges from much of the bad weather.

On the 13th an anticyclone passed from Australia on to the north Tasman Sea, and a fresh type of weather was introduced. From the 14th till the 18th westerlies prevailed. Western and far southern districts again recorded heavy rains. In Southland rivers were high for much of the first half of the month and some local flooding occurred.

The third type of weather began to set in on the 19th, and still held at the end of the month. Winds at most places developed an easterly component. A series of cyclones developed in the Tasman Sea and passed slowly across the Dominion. From the 20th onwards dull and misty weather was practically continuous. Rain was widespread on most days, and the dry spell experienced for so long in many eastern districts was finally broken. A deep cyclone which passed by the northern extremity of the Dominion on the 25th caused very heavy rain east of the main range in the North Island between the 25th and the 28th. Severe floods occurred in the Poverty Bay and Hawke's Bay districts, and the Manawatu River also overflowed its banks. At Gisborne 5·63 in. of rain fell on the 26th, the heaviest fall in twenty-four hours yet recorded there.

From the 28th onward the heaviest rains occurred farther southward, and the situation in Hawke's Bay was gradually relieved.

RAINFALL FOR MAY, 1933, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	4·33	22	0·75	6·86
Russell	10·26	22	2·62	7·05
Whangarei	9·46	26	1·93	7·95
Auckland	6·42	23	0·79	4·66
Hamilton	6·02	22	1·07	4·72
Rotorua	6·00	17	1·76	5·72
Kawhia	8·55	22	1·51	5·42
New Plymouth	9·36	25	2·21	6·21
Riversdale, Inglewood	15·21	24	4·32	9·74
Whangamomona	12·70	13	2·73	6·88
Hawera	6·93	23	1·58	4·66
Tairua	8·46	21	1·24	7·26
Tauranga	5·42	17	1·35	5·15
Maraehako Station, Opotiki ..	4·97	14	1·16	5·63
Gisborne	11·99	15	5·63	5·42
Taupo	4·46	17	1·10	3·98
Napier	7·19	11	3·06	3·71
Hastings	8·52	12	3·48	3·33
Whakarara Station, Kereru ..	12·55	19	4·09	..
Taihape	4·11	20	1·06	3·50
Masterton	4·76	21	1·45	4·02
Patea	7·83	20	2·15	4·19
Wanganui	3·86	17	1·15	3·36
Foxton	4·40	15	1·32	3·23
Wellington	5·84	17	1·16	3·98
South Island.				
Westport	8·89	21	1·37	8·35
Greymouth	9·51	18	1·67	8·08
Hokitika	10·74	19	2·02	9·71
Ross	12·10	16	3·02	10·05
Arthur's Pass	12·80	17	3·45	13·04
Okuru	14·75	13	3·00	11·09
Collingwood	6·97	14	1·57	8·99
Nelson	2·74	12	0·98	3·06
Spring Creek	3·36	9	1·30	2·95
Hanmer Springs	2·28	13	0·72	4·39
Highfield, Waiau	2·79	9	0·55	3·19
Gore Bay	3·83	11	0·69	3·31
Christchurch	3·28	14	0·75	2·53
Timaru	1·00	7	0·30	1·41
Lambrook Station, Fairlie ..	1·88	8	0·59	1·50
Benmore Station, Clearburn ..	2·00	14	0·27	1·81
Oamaru	1·00	13	0·19	1·59
Queenstown	2·86	17	0·77	2·57
Clyde	0·87	6	0·32	1·00
Dunedin	3·86	19	0·65	3·11
Wendon	2·46	10	0·90	2·02
Gore	4·66	20	1·23	2·56
Invercargill	4·88	22	1·20	4·34
Puysegur Point	6·27	22	0·95	6·74
Half-moon Bay	7·02	24	0·88	4·75

CERTIFICATION OF SEED POTATOES.

PROVISIONAL CERTIFICATES ISSUED FOR SEASON 1932–33.

A LIST of growers who have received provisional certificates in connection with the system of Government certification of seed potatoes in the past season is printed below. Provisional certificates are issued with the object of affording growers some indication of the general standard of their crops and assisting them in the disposal of their seed. Certification tags to be attached to the sacks are issued later, provided that an officer of the Department of Agriculture inspects the graded seed potatoes and is satisfied that they are still of the same standard of purity and freedom from disease as was indicated by the field inspection.

A new departure has been made in this year's list. The cropping-power figure, which has been published in previous seasons, is now omitted, and its place is taken by a "group number." All provisionally certified crops have been placed into one of ten groups. Group 1 contains those crops approaching perfection in regard to cropping-power and freedom from virus and similar diseases. The standard of the crops in each succeeding group is progressively lower, until Group 10 contains those crops with a comparatively high percentage of virus, and the passing of which is justified only on the grounds that no better seed is available.

In comparing crops it should be kept in mind that the differences between those in any two consecutive groups are very small, and under such circumstances cost and transport factors should receive consideration. On the other hand, there is a definite falling-away in quality from Group 1 towards Group 10.

NOTE.—Lines entered under the name of the Government Pure Seed Station comprise relatively small areas of "selected" seed. Applications for this seed should be made to the Government Pure Seed Station, P.O. Box 4, Lincoln, Canterbury.

LIST OF GROWERS.

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area, in Acres.
Dakota :—			
Allen, A., R.M.D., Leeston	6	..	5
Barnett, R., Dunsandel	6	..	3
Barr, H. C., R.M.D., Springston	6	0·2	3
Boag, R. A., R.M.D., Greendale	5	..	2
Burnett, J. N., Templeton	5	..	1
Burrowes, J., Mitcham, via Rakaia	6	0·4	10
Chambers, A. J., R.M.D., West Melton	6	..	5
Chambers, L. J., R.M.D., Weedon's	7	0·2	2
Crawford, J. A., Yaldhurst, via Christchurch	8	..	2
Crozier, W. J., Mitcham, via Rakaia	7	0·3	14
Curragh, J., Templeton	6	..	1
Foster, T. C., Springston Rural, Ladbrook's (Line B)	7	..	5
Gardiner, C., Mitcham, via Rakaia	7	..	4
Gardiner, O. J., Dunsandel	6	0·8	5
Government Pure Seed Station, Box 4, Lincoln	6	..	..
Jones, C. H., R.M.D., Winchmore, via Ashburton	8	0·8	7
Jowers, G. C., R.M.D., Springston	7	..	3
Jowers, J. W., R.M.D., West Melton	7	..	1
Kempthorne, C. O., Coutt's Island, Kaiapoi	8	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area, in Acres.
Dakota—continued.			
Marshall, D., R.M.D., Leeston	7	..	10
McCullough, S. G., Rangitira Valley, Temuka	8	..	1
McPhail, W. A., Mitcham, via Rakaia	6	0·6	8
Oakley, H. R., R.M.D., Eiffleton, via Ashburton	8	1·8	2
Payne, A. E., R.M.D., Springston	8	..	3
Petrie, J., jun., Swannanoa	6	..	5
Petrie, J., sen., Swannanoa	8	..	1
Rolston, G., R.M.D., Weedon's	8	0·3	7
Ryan, P. F., R.M.D., Weedon's	6	..	12
Steele, J., R.M.D., Kimberley	8	..	1
Stewart, A., Templeton	6	..	3
Topham, J. W., Arowhenua, Temuka	8	..	1
Tweedy, S., R.M.D., Dunsandel	5	..	12
Walker, C. E., R.M.D., West Melton	5	..	4
Wolff, R. G., R.M.D., Horrelville	6	..	3
Aucklander Short Top :—			
Adams Bros., Waddington	4	..	1
Adams, K. and R., Sheffield	4	0·2	1
Ballantyne, C. T., Timaru	3	..	1
Barnett, R., Dunsandel	2	..	3
Barratt, W. H., Springlands, Blenheim	2	0·1	1
Burgess, D., West Plains, Invercargill	3	0·3	1
Burgess, R. W., care of F. Merrin, jun., R.M.D., East Eyreton	6	1·0	4
Carroll, A. D., R.M.D., Southbridge (Line A)	6	0·4	4
Carroll, A. D., R.M.D., Southbridge (Line B)	2	..	2
Crozier, W. J., Mitcham, via Rakaia	2	..	1
Crump, F., Springston	2	1·0	3
Dyer, H., Southbrook, Rangiora (Line A)	3	..	3
Eder, W., R.M.D., Sefton	6	..	15
Fowler, G., Temuka	4	..	1
Government Pure Seed Station, Box 4, Lincoln	3	..	..
Gray, R., St. Andrew's	4	..	1
Guy, T. A. and E. B., Yaldhurst, Christchurch	6	..	2
Hegan, J., Southbrook, Rangiora (Line A)	6	..	2
Heron, F., R.M.D., Rangiora (Line A)	7	0·2	10
Jellie, J., Russley Road, Fendalton, Christchurch	5	..	3
Johnston, H. W., Dunsandel	3	1·1	2
Kelleher, T., Pleasant Point, via Timaru	5	..	1
Kempthorne, C. O., Coutt's Island, Kaiapoi	3	..	1
Marshall, D., R.M.D., Leeston	2	1·0	10
Martin, A., Box 42, Morven	4	..	1
Martin, W. E., R.M.D., Kaiapoi	7	0·2	17
Morgan, D., Cheviot	3	..	4
Muir, J. F., Yaldhurst, Christchurch	5	..	2
McCullough, S. G., Rangitira Valley, Temuka	6	..	1
McKenzie, J. R., Yaldhurst, Christchurch	4	..	10
McPhail, W. A., Mitcham, via Rakaia	3	1·0	1
Nairn, G., Lakeside	5	1·0	4
Oakley, W., R.M.D., Halkett	4	..	5
Petrie, H., R.M.D., Rangiora (Line A)	4	..	2
Petrie, H., R.M.D., Rangiora (Line B)	4	0·2	2
Petrie, J., jun., Swannanoa	2	..	7
Petrie, J., sen., Swannanoa	2	..	3
Pleasant Point District High School, Pleasant Point	3	0·2	1
Porter, E., St. Andrew's	2	0·2	2
Poulton, A. D., R.M.D., West Eyreton	5	0·5	4

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area, in Acres.
Aucklander Short Top—continued.			
Prosser, L. W., Leeston	3	..	4
Rangiora High School, Rangiora	4	0·2	1
Rathgen, A. E., R.M.D., Leeston	5	1·3	5
Redmond, C., R.M.D., Kimberley	3	..	5
Relling, H., R.M.D., Tycho, Timaru	6	..	3
Rich, A. J., R.M.D., Kaiapoi	3	..	10
Robinson, R. G., Box 4, Papanui (Line A)	3	0·1	1
Robinson, R. G., Box 4, Papanui (Line B)	7	0·4	2
Rolls, B. R. C., Halswell, Christchurch	5	..	3
Roper, P. F., R.M.D., Halkett	3	0·2	2
Roper, R. S., R.M.D., Halkett	3	0·2	3
Ryan's Estate, R.M.D., Springston	4	..	6
Seyb, L., Washdyke, Timaru (Line A)	3	..	1
Simpson, F. F., Morven	2	..	5
Smith, E. A., R.M.D., Springston	3	1·4	20
Smith, G. G., R.M.D., Broadfields	2	..	1
Spillane, A., Temuka	3	..	2
Stevenson, G., Weston, Oamaru	3	..	1
Swanson, R., Selwyn	3	1·5	3
Timaru Boys' High School, Timaru	3	..	5
Weeber, H., Englefield Road, Belfast	4	..	5
Westaway, R., R.M.D., Courtenay	3	0·2	6
Wolff, R. G., R.M.D., Horrelville	4	..	5
Arran Chief :—			
Bannatyne, Mrs. E., Waikouaiti	2	0·2	2
Barnett, A. W., Morven	4	0·3	1
Bell, J. F., Stirling (Line A)	4	0·6	2
Bell, J. F., Stirling (Line B)	3	0·7	6
Borstal Institute, Invercargill	3	0·5	1
Gilchrist, P. P., Retreat Road, Waikiwi, Invercargill	4	0·6	2
Gore Experimental Area, Gore	3	0·4	1
Graham, J., Mosgiel	5	0·6	2
Grant, A., Waimate (Line A)	5	0·8	1
Gray, J. L., Bankfield, St. Andrew's (Line A)	5	0·8	1
Gray, J. L., Bankfield, St. Andrew's (Line B)	3	..	4
Hayman Bros., Willowbridge (Line A)	3	0·8	1
Hayman Bros., Willowbridge (Line B)	3	..	1
King, R. M., Tuatapere	5	0·2	2
Knowler, C. E., Tuatapere	4	..	1
Knowler, H., Te Waewae	3	0·8	4
Knowler, H. C., Te Waewae	4	..	1
Martyn, F., Seaward Downs	4	0·5	2
Quirk, L., East Gore	4	0·4	1
Reid, W. P., Maheno	5	..	1
Robinson, R. G., Box 4, Papanui, Christchurch	3	0·1	1
Saunders, E. E., Studholme Junction (Line A)	3	..	1
Saunders, E. E., Studholme Junction (Line B)	2	..	9
Saunders, F. L., Studholme Junction	3	..	1
Smith, A. L., Mosgiel, Otago	4	0·4	1
Teschner, C. A., Chatton Road, Gore	4	0·4	1
Wright, L. T., Annat, Canterbury	3	0·1	3
Aucklander Tall Top :—			
Bailey, J., R.M.D., Kaiapoi	7	..	7
Cross, H. E., Sandy Knolls	4	..	5
Eder, R., R.M.D., Sefton	6	1·5	1

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area, in Acres.
Aucklander Tall Top—continued.			
Frazer Bros., Southbrook, Rangiora	6	..	4
Frost, C. H., P.O., Balcairn	4	..	5
Government Pure Seed Station, Box 4, Lincoln	5	..	..
Guy Bros., R.M.D., Rangiora	6	..	10
Guy, T. A. and E. B., Yaldhurst, Christchurch	6	..	2
Hawke, McKenzie, Landborough Road, Timaru	7	..	1
Hewson, R. H., Seadown, Timaru	7	..	1
Hills, W., R.M.D., Rangiora	7	..	4
Martin, A., Box 42, Morven	7	..	1
Robson, F. H., Lincoln	6	1·0	6
Seyb, L., Washdyke, Timaru	6	..	1
Steele, J., R.M.D., Darfield	6	0·6	2
Watkins, E. R., Springbank, Rangiora	6	..	3
Arran Banner :—			
Barnes, W., 199 Highsted Road, Styx, Christchurch	5	0·2	2½
Burgess, D., West Plains, Invercargill	3	0·3	1
Burrowes, J., Mitcham, via Rakaia	5	..	1
Craig, G. H., Mosgiel	6	0·5	2½
Crozier, W. J., Mitcham, via Rakaia	3	..	1
Government Pure Seed Station, Box 4, Lincoln	3	..	..
Macalister, J., Kauana, Southland	4	..	1
McNae, F., R.M.D., Courtenay	4	0·1	5
Spillane, A., Temuka	5	..	1
Tutton, F. A., R.M.D., Broadfields, Christchurch	6	..	1
Wilson, C. H., Lorneville, Invercargill	3	..	1
Wilson, J. C., Tawanui, Catlins	3	..	1
Wright, L. T., Annat	4	..	1
King Edward :—			
Anderson, A., Stirling, Otago	4	..	3
Burgess, D., West Plains, Invercargill	3	..	1½
Brown, W. E., Orepuki	5	0·2	2½
Gilchrist, P. P., Waikiwi, Invercargill	4	..	2
Gore Experimental Area, Gore	4	..	1
Knowler, H., Te Waewae	4	1·0	2
Knowler, H. C., Te Waewae	4	0·7	1½
Kokay, S., Tuatapere	4	..	8
Martyn, F., Seaward Downs	4	..	1
Meadows, L. F., Mokotua, Southland	4	..	1
Milburn, M., Waianiwa, Invercargill	3	0·2	1½
Moffett, N. J., Tokanui	4	..	3
Taylor, H., Enfield, via Oamaru	4	..	1
Up-to-Date :—			
Canterbury Agricultural College, Lincoln	6	..	1
Guy, T. A. and E. B., Yaldhurst, Christchurch	6	..	2
Robinson, R. G., Box 4, Papanui, Christchurch (Line B)	5	..	1
Smyth, H., care of W. Munro, Mount Hutt R.M.D., Rakaia	7	..	2
Steele, J., R.M.D., Kimberley	6	..	1
Westaway, R., R.M.D., Courtenay	5	..	1
Wright, L. T., Annat, Canterbury	7	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area, in Acres.
Epicure :—			
Jowers, J. W., R.M.D., West Melton*	10	..	1
McLachlan, G., R.M.D., Southbridge*	10	..	10
Tweedy, S., R.M.D., Dunsandel*	9	..	1
Shellock, W., R.M.D., Te Pirita, via Rakaia	6	..	2
Majestic :—			
Cross, H. E., Sandy Knolls	5	..	1
Crozier, W. J., Mitcham, via Rakaia	3	..	1
Robinson, R. G., Box 4, Papanui, Christchurch	4	..	1
Early Rose :—			
Burns, R. A. C., Mead Settlement, Rakaia	5	..	3
Weaver, J., R.M.D., Te Pirita, via Rakaia	5	..	3
Weaver, J. H., R.M.D., Te Pirita, via Rakaia	5	..	1
Jersey Bennes :—			
Burgess, D., West Plains, Invercargill	2	..	1
Gore Experimental Area, Gore	2	..	1
Stevenson, G., Weston, Oamaru	2	..	1
Bresee's Prolific :—			
Allen, A., R.M.D., Leeston	9	..	5
Guy, T. A., and E. B., Yaldhurst, Christchurch	9	..	8
Marshall, D., R.M.D., Leeston	9	0·3	20
Iron Duke :—			
Government Pure Seed Station, Box 4, Lincoln	6	..	..
Guy Bros., R.M.D., Rangiora	9	..	5
Herridge, F. G., Woodend, via Kaiapoi	9	..	4
Robin Adair :—			
Evans, R. G., R.M.D., Lowcliffe, via Ashburton	9	..	1
Marshall, D., R.M.D., Leeston	8	..	5
Kerr's Pink :—			
Government Pure Seed Station, Box 4, Lincoln	5	..	..
Shellock, W., R.M.D., Te Pirita, via Rakaia	6	..	1
Arran Consul :—			
Government Pure Seed Station, Box 4, Lincoln	3	..	..
Robinson, R. G., Box 4, Papanui, Christchurch	4	..	1
Early Regent Bolter :—			
Oakley, W., R.M.D., Halkett	3	..	5
Robinson, R. G., Box 4, Papanui, Christchurch	4	..	1
Great Scot :—			
Wright, L. T., Annat, Canterbury	6	0·2	4
Northern Star :—			
Robinson, R. G., Box 4, Papanui, Christchurch	6	..	2
Arran Victory :—			
Smyth, H., care of W. Munro, Mount Hutt R.M.D., Rakaia	5	..	2

* These lines are taller-growing and rather later-maturing than the usual Epicure, giving also a heavier yield; they are not of the typical "bolter" type, however.

—*Fields Division.*

LEAF-ROLL OF THE POTATO.

Leaf-roll is the most serious of the virus diseases in New Zealand. The infected plants may usually be identified by their smaller size, slightly paler foliage, and upright habit of growth. On closer inspection the lower leaves are seen to be rolled upwards and become funnel-shaped, as illustrated. These leaves are harsh and brittle to the touch, and when shaken give a rattling sound.

POTATO LEAVES SHOWING STIPPLE-STREAK.

Stipple-streak is not so widely spread as leaf-roll and mosaic (see next page), but when present will often kill the infected plants right off. The leaves are crinkled, and curl downwards at the tips, giving the plant a rounded and often bunchy appearance. Dark streaks make their appearance on the leaves, and these extend down the veins to the mid-rib. Eventually the lower leaves die and drop off leaving bunches of leaves on the top of bare stems.

POTATO MOSAIC.

Mosaic is a virus disease which may be distinguished by a mottling and crinkling of the leaves, which are smaller than those in healthy plants. If an infected plant is shaded from the sun the pale-green mottling becomes more evident. In severe attacks the plants may be much reduced in size, the leaves very crinkled, and the mottling so pronounced as to make the whole plant appear pale in colour.

APHIDES ON POTATO PLANT.

These insects are responsible for the transmission of virus diseases in a crop. They suck the sap of leaves and stems, and in moving from plant to plant carry infection with them.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

LICK FOR SHEEP.

"INQUIRER," Fairlie :—

Would you kindly give me a recipe for a suitable lick (containing salt, molasses, iodine, sulphur, phosphates, and iron) for sheep in the Fairlie district? I have weatherproof lick-boxes, so can use the lick in loose form.

The Live-stock Division :—

The following are the proportions in which the minerals mentioned by you may be used as a lick for sheep: Agricultural salt, 75 lb.; bonemeal, 50 lb.; flowers of sulphur, 2 lb.; sulphate of iron, 2 lb.; potassium iodide, 2 oz. Dissolve the potassium iodide in one quart of water and sprinkle on to the salt, which is spread thinly on a clean floor. Mix thoroughly, adding the other ingredients. The molasses, approximately 7 lb. to 10 lb., is added last with the minimum amount of water, as salt has a tendency to absorb atmospheric moisture. The addition of a small amount of raw linseed-oil tends to make the mixture waterproof, thus protecting the more soluble ingredients from the weather. Have the sulphate of iron very finely powdered. Limonite, 5 lb., may be used in lieu of the sulphate of iron.

USE OF ARSENIC PENTOXIDE IN HARD-FERN CONTROL.

C. K. HANHAM, Reikiorangi :—

In the *Journal* for March, 1932, there was printed an article on hard-fern control by spraying with arsenic pentoxide. I should be glad if you would give me the following information: (1) Does the spraying kill the grass? (2) Is there any danger to the user as in the case of sodium chlorate?

The Fields Division :—

(1) As hard-fern grows in a dense mass, there is usually no grass growing in combination with it. The only likelihood is that you may spray a little grass round the edges of the patch, in which case no harm will result unless applied very heavily. The hard-fern patch should not be more than completely moistened with spray. (2) There is no danger to the user, but as arsenic pentoxide is poisonous to stock they should not be allowed on to the ground until after rain.

RIDDING A PADDOCK OF RUSHES.

"FARMER," Gisborne :—

A paddock of mine has been stumped, cleared, and drained. It is not ploughable, as there are so many logs, roots, &c., not far under the surface. I sowed in good grass and it came away very well. Since clearing, a lot of rushes have come up. Can you tell me if I can get rid of them by spraying, or what is the right time of year to dig them out?

The Fields Division :—

There is no material that can be applied as a spray for destroying rushes. Rushes are usually dug out during the winter months and gathered into large heaps and either left to rot or later burned. It is advisable to broadcast a little grass-seed on the bare patches left after removing the rushes. Efficient drainage in itself is not always successful in controlling rushes, and you may not obtain permanent relief until the land has been under cultivation and thoroughly sweetened.

FOWL MANURE FOR ORCHARD.

"OLD SUBSCRIBER," Auckland :—

I have means of obtaining a large quantity of fowl manure mixed with straw from the scratching-sheds. What is the correct time to apply it to the trees in a commercial orchard, and the quantity for mature trees?

The Horticulture Division :—

To manure an orchard economically and effectively careful consideration should be given to all the circumstances of trees, soil, and climate. In the absence of this information, you are recommended to spread 3 to 4 tons of the fowl manure mixed with straw per acre, and plough it in during early winter, or in early spring if it is more convenient to do so.

Use of Lime with Nitrogenous Fertilizers: An Explanation.—The answer to an inquiry published in last month's *Journal* (page 313) stated that lime should not be mixed with any manure which contains nitrogen, as it releases the latter. The reference in this case was to *burnt* lime. Carbonate of lime (crushed limestone) may be safely used in such mixtures.

PERIODICALS OF THE IMPERIAL AGRICULTURAL BUREAUX.

THE third annual report of the Executive Council of the Imperial Agricultural Bureaux, covering the year ended 31st March, 1932, indicates that this is the first full year in which practically all the eight bureaux have been issuing printed journals appearing regularly on definite dates. These publications may be summarized as follows :—

(1) *List of Publications relating to Soils and Fertilizers.* Monthly. Bureau of Soil Science, Rothamsted Experimental Station, Harpenden.

(2) *The Veterinary Bulletin.* Monthly. Bureau of Animal Health, Veterinary Research Laboratory, Weybridge.

(3) *Nutrition Abstracts and Reviews.* Quarterly. Bureau of Animal Nutrition, Rowett Research Institute, Aberdeen.

(4) *Plant Breeding Abstracts.* Quarterly. Bureau of Plant Genetics, Plant Breeding Institute, School of Agriculture, Cambridge.

(5) *Herbage Extracts.* Quarterly. Bureau of Plant Genetics (Herbage Plants), Welsh Plant Breeding Station, Aberystwyth.

(6) *Horticultural Abstracts.* Quarterly. Bureau of Fruit Production, East Malling.

(7) *Bulletin of Animal Genetics.* Quarterly. Bureau of Animal Genetics, Animal Breeding Research Department, University of Edinburgh.

(8) *Abstracts on Agricultural Parasitology* (published in the *Quarterly Journal of Helminthology*). Bureau of Agricultural Parasitology, Institute of Agricultural Parasitology, St. Albans.

The main function of the publications enumerated is that of abstracting (and to a lesser extent reviewing) current scientific literature in their respective fields. To quote the Annual Report of the Executive Council: "In all, the number of articles of scientific interest noticed in the various journals of the Bureaux in 1930–31 exceeded 10,000. It must be to the advantage of research workers in the Empire to have these brought to their notice in convenient form and at regular intervals. Without the assistance of organizations such as the Bureaux the individual must experience great difficulty in keeping abreast of modern scientific literature. Yet no research worker can afford not to keep himself so informed." The publication date of the report is 1933.